A CONDENSED

BOTANY;

DESIGNED AS A

TEXT-BOOK FOR COMMON SCHOOLS, AND AN ELEMENTARY WORK IN HIGH SCHOOLS AND ACADEMIES.

BY

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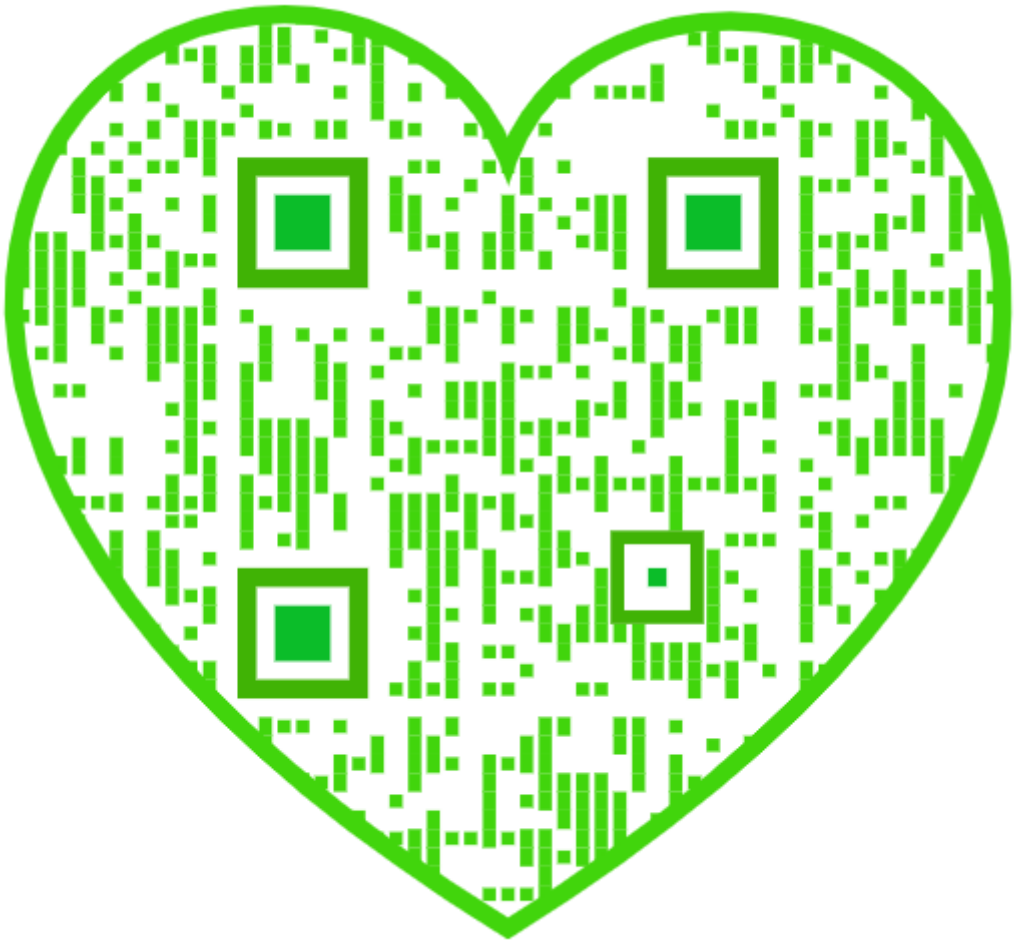

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PREFACE.

This book, though Elementary, is not designed for Primary Schools particularly, neither is it expected that it will take the place of such works as are intended for the classes of Seminaries and Colleges.

It has been prepared with special reference to the wants and demands of the boys and girls of our *Common Schools.*

It is not reasonable to suppose that any considerable number of the pupils, whether in the country or in the town, will become skilled botanists; yet it is possible for the great majority of them to obtain some knowledge of the Plan of Vegetation.

I have aimed to use but few words, feeling assured, that if concise and exact statements and definitions are carefully studied, the subjects treated of may be fully understood.

A comparatively full Glossary, or Dictionary of Terms, is added, for the convenience of the pupil.

The Illustrations, all of which are from nature, are from the pencil of Mrs. F. PIERCE SMITH, of Bloomington; and the Engravings by A. MAAS, Chicago.

The Table of Contents will assist both teacher and learner in fixing upon the more important points of each lesson, and will be particularly useful in reviews.

J. A. SEWALL.

NORMAL, JULY 8, 1872.

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GLOSSARY;

OR

DICTIONARY OF TERMS USED IN DESCRIBING PLANTS.

Abortive: imperfectly formed or rudimentary.

Achenium: (plural *Achenia,*) a one-seeded, seed-like fruit.

Acúminate: taper-pointed.

Acute: merely sharp-pointed, or ending in a point less than a right angle.

Adventitious: out of the proper or usual place.

Altérnate (leaves): one after another.

Annual (plant): flowering and fruiting the year it is raised from the seed, and then dying.

Anther: the essential part of the stamen, which contains the pollen.

Axil: the angle on the upper side between a leaf and the stem.

Axillary (buds, etc.): occurring in an axil.

Berry: a fruit, pulpy or juicy throughout, as a grape.

Biénnial: of two years' continuance; springing from the seed one season, flowering and dying the next.

Blade of a leaf: its expanded portion.

Bract: bracts are the leaves of an inflorescence, differing more or less from ordinary leaves.

Bractlet: a bract seated *on* the pedicel or flower-stalk.

Bud: a branch in its earliest or undeveloped state.

Bulb: a leaf bud with fleshy scales, usually subterranean.

Calyx: the outer set of the floral envelopes or leaves of the flower.
Catkin: a scaly, deciduous spike of flowers; an ament.
Cone: the fruit of the Pine family.
Cordate: heart-shaped.
Corm: a solid bulb, like that of the Crocus.
Corólla: the leaves of the flower within the calyx.
Córymb: a flat or convex flower-cluster.
Culm: a straw; the stem of grasses and sedges.
Cycle: one complete turn of a spiral or circle.
Cyme: a cluster of centrifugal inflorescence.

Dentate: toothed (from the Latin *dens*, a tooth.)
Diœcious: having the stamens and pistils in separate flowers on different plants.
Divided: cut into divisions extending about to the base or midrib.
Dorsal: pertaining to the back.
Elliptical: oval or oblong, with the ends regularly rounded.
Entire: the margins not at all toothed, notched or divided, but even.
Epiphyte: a plant growing on another plant, but not nourished by it.

Filament: the stalk of a stamen.
Fleshy: composed of firm pulp or flesh.
Floral-envelopes: the leaves of a flower.
Flower: the organs of reproduction (of flowering plants,) with their envelopes.
Flower-bud: an unopened flower.
Fruit: the matured ovary and all it contains or is connected with.

Glómerule: a dense head-like cluster.

Herbaceous: of the texture of common herbage; not woody.

Imperfect (flower): wanting either stamens or pistils.
Incomplete (flower): wanting calyx or corolla.
Internode: the part of a stem between two nodes.

Leaflet: one of the divisions or blades of a compound leaf.
Linear: narrow and flat, with the margins parallel.

Midrib: the middle or main rib of a leaf.

Net-veined: furnished with branching veins forming net-work.
Node: a knot; the "joints" of a stem, or the part whence a leaf or a pair of leaves springs.

Obcórdate: heart-shaped, with the broad and notched end at the apex instead of the base.
Oblánceolate: lance-shaped, with the tapering point downwards.

Palmate: having the leaflets or the divisions of a leaf all spread from the apex of the petiole, like the hand with the outspread fingers.
Pédicel: the stalk of each particular flower of a cluster.
Pedúncle: a flower-stalk, whether of a single flower or of a flower-cluster.
Peltate: shield-shaped; said of a leaf, whatever its shape, when the petiole is attached to the lower side, within the margin.
Perennial: lasting from year to year.
Perfect (flower): having both stamens and pistils.
Perfóliate (leaf): surrounding the stem at the base.
Petal: a leaf of the corolla.
Pétiole: a foot-stalk of a leaf; a leaf-stalk.
Pistil: the seed-bearing organ of the flower.
Pollen: the fertilizing powder of the anther.

Racéme: a flower-cluster, with one-flowered pedicels arranged along the sides of a general peduncle.

Receptacle: the axis or support of a flower.

Regular: having all the parts similar.

Rib: the principal piece, or one of the principal pieces, of the frame-work of a leaf.

Rootlets: small roots or root-branches.

Root-stock: root-like trunks or portions of stems on or under ground.

Runner: a slender and prostrate branch, rooting at the end or at the joints, as of a strawberry.

Sepal: a leaf or division of the calyx.

Separated Flowers: those having stamens or pistils only.

Sessile: sitting; without any stalk, as a leaf destitute of petiole, or an anther destitute of filament.

Spike: an inflorescence like a raceme, only that the flowers are sessile.

Stigma: the part of the pistil which receives the pollen.

Style: a part of the pistil which bears the stigma.

Suckers: shoots from subterranean branches.

Symmetrical (flower): similar in the number of parts of each set.

Tendril: a thread-shaped body used for climbing; it is either a branch, as in Virginia Creeper, or a part of a leaf, as in the Pea.

Terminal: borne at or belonging to the extremity or summit.

Tuber: a thickened portion of a subterranean stem or branch, provided with eyes (buds) on the sides.

Umbel: the umbrella-like form of inflorescence.

Veinlets: the smaller ramifications of veins.

BOTANY.

LESSON I.

THE STUDY OF PLANTS.

1. When we examine Plants, to find out how they grow, how they are classed, what parts they are made up of, and what uses these parts serve, we are studying **Botany.**

2. If we look at the plants growing in the field or in the forest, we see that they differ greatly in form, in size, in the shape of the leaves, in the appearance of the flowers, and in the character of the fruit. Yet we shall observe that all plants are constructed on one simple plan.*

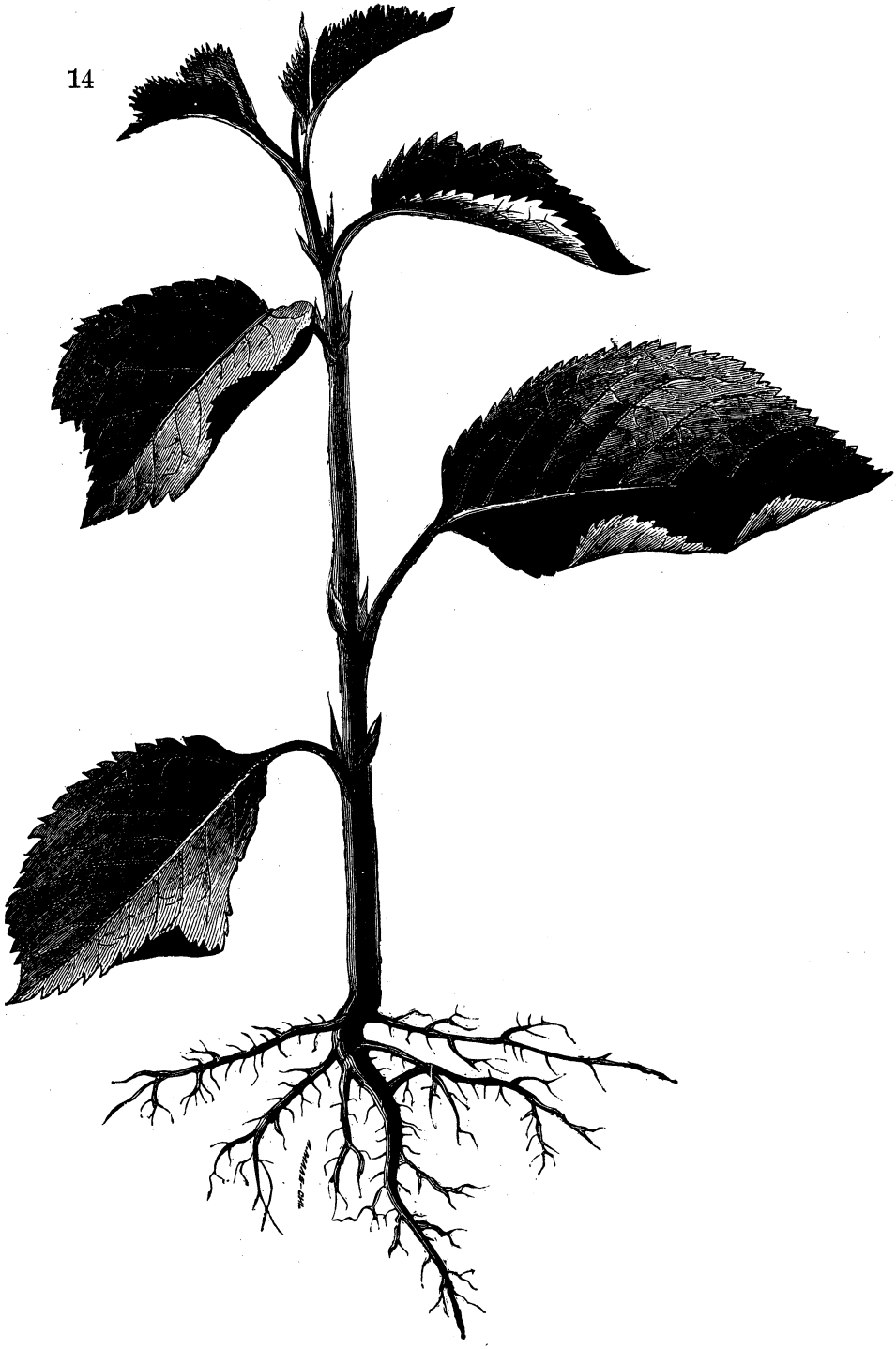
3. Each plant consists of **Root, Stem** and **Leaves.**

4. We find parts of the plant that take particular names, such as bud, flower, fruit, thorn, &c., that do not, at first sight at least, appear to be either root, stem or leaf; but if we carefully study the *plan* of the plant, we shall discover that each of these is some form of root, stem or leaf, or some combination of these parts.

5. The **Root** is that part of the plant which grows *downward*, commonly entering the soil, from which it takes nourishment.

It branches *indefinitely and without order, but bears no other appendages.* Its ultimate branches are called **Rootlets.**

NOTE. It would be well for the teacher to call attention to such plants as differ greatly: 1. In *form*, as the *cabbage* and a *blade of grass*. 2. In *size*, as the *oak* and the *dandelion*. 3. In the *flower*, as the *common plantain* and the *peony*. 4. In the *fruit*, as the *cherry* and the *squash*.



ROOT, STEM AND LEAVES.

6. The **Stem** is that part of the plant which commonly grows upward into the light and air, bearing leaves.

It consists of a succession of leaf-bearing points, called **Nodes**, separated by naked joints, called **Internodes.**

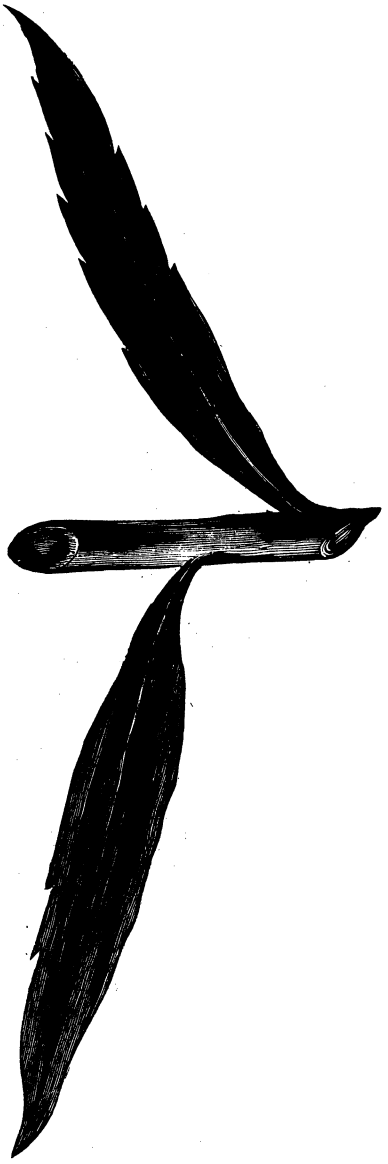
7. **Leaves** are expanded appendages of the stem.

They consist of loose cellular tissue, supported by a network of woody fiber, called **Ribs** or **Veins**, and are covered by a thin but quite firm skin, called **Epidermis.**

8. They are sometimes attached to the stem by a small stalk, called the **Petiole** or leaf-stalk. The petiole sometimes bears, at its base, two small leaf-like bodies, called **Stipules.**

LEAF. PETIOLE. STIPULES.

9. Some leaves have no leaf-stalk, but are borne directly on the stem. Most leaves are without stipules.



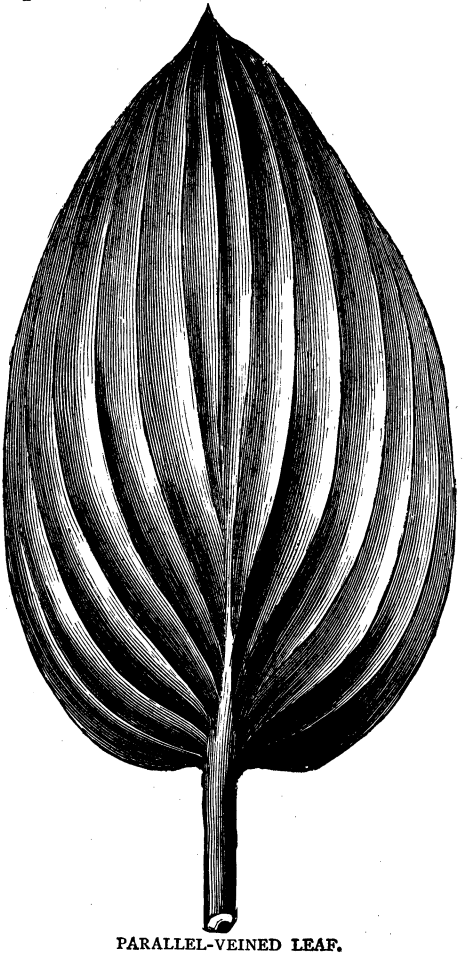
SESSILE LEAVES.

10. The larger parts of the net-work of woody fiber are called **ribs**; the smaller, **veins**; and the smallest, **veinlets.**

LESSON II.

LEAVES.

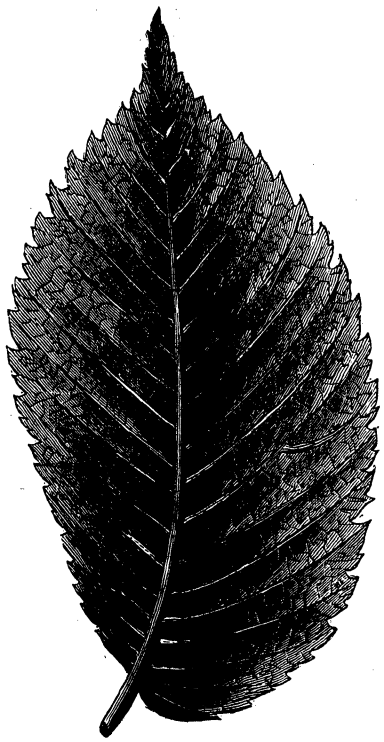
11. We will examine the leaves first, as they are easily seen and handled, and as they present a greater variety of forms, and answer a greater variety of purposes, than do both of the other parts combined.



PARALLEL-VEINED LEAF.

NET-VEINED LEAF.

12. Take a leaf from a corn-stalk; tear it. You will observe that it will split or tear quite easily in one direction—from end to end. If you look carefully at the leaf, you will see that there are many small ridges or ribs running in the same direction, parallel to each other. Such leaves are called **Parallel-veined.**



FEATHER-VEINED LEAF.

13. Take the leaf of a maple or of a squash vine, and tear it. You will observe that it will not tear regularly,

NOTE.—The pupil should make a collection of leaves, and separate the parallel-veined from the net-veined leaves.

that is, not in any particular direction. Hold it up to the light, and you will see that the ridges or ribs run in almost every direction, and form a sort of net-work. Such leaves are called **Net-veined.**

14. In net-veined leaves, you will frequently find that a single strong rib, called the midrib, which seems to be a continuation of the leaf-stalk, runs directly through the middle of the leaf to the very top, and that from this midrib the lateral or side veins all diverge.

Such leaves are called **Feather-veined.**

15. In other net-veined leaves, the leaf-stalk seems to divide, at the point where it joins the leaf, into three or more portions or ribs, of nearly equal size; and these give off veins and veinlets.

Such leaves are called **Radiate,** or **Palmate-veined.**

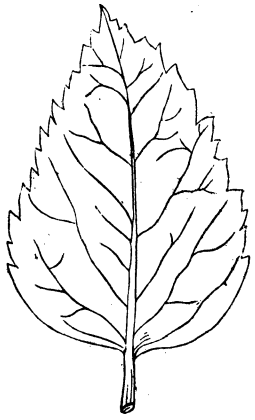
LESSON III.

THE FORMS OF LEAVES.

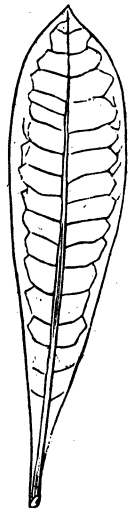
16. Leaves have an almost infinite variety of forms. Such names are given them as their forms suggest.

17. Here is a group, each of which is named as to its *general form:* Linear, Lanceolate, Oblong, Elliptical, Ovate, Oblanceolate, Spatulate, Obovate. You will observe that the four last named taper toward the base.

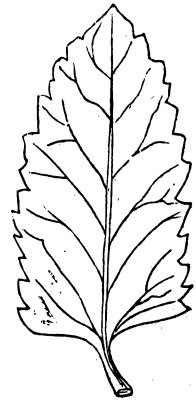
RADIATE-VEINED LEAF.



OVATE.

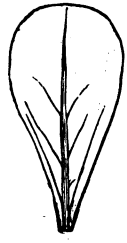


OBLANCEOLATE.

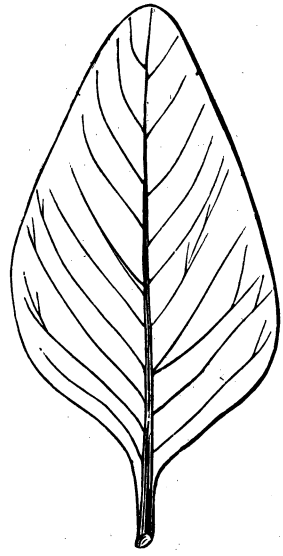


OBLONG.

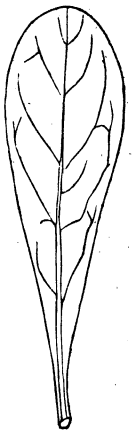
LANCEOLATE.



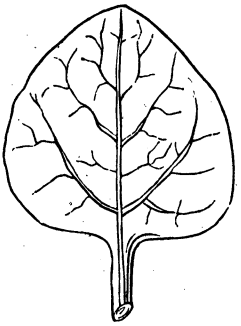
CUNEATE.



ELLIPTICAL.



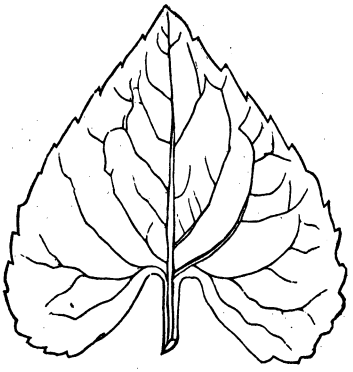
SPATULATE.



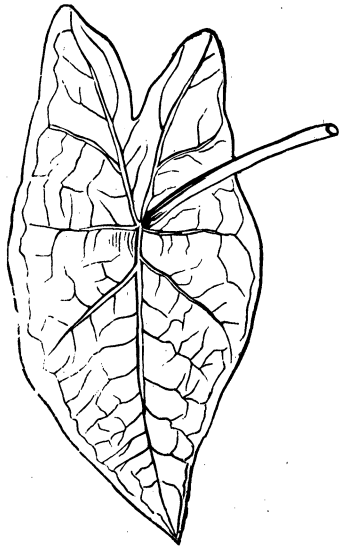
OBOVATE.

LINEAR

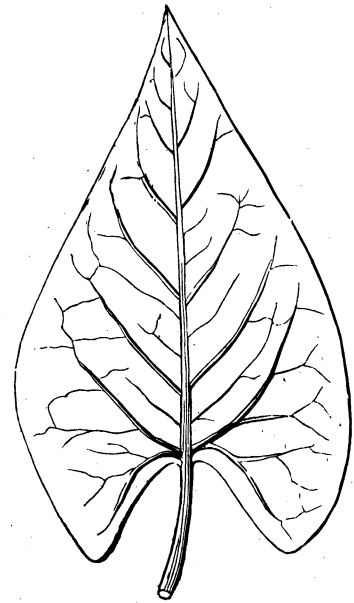
18. Here is a group, each named from the shape of the *base:* Auriculate, Hastate, Cordate, Reniform, Peltate.



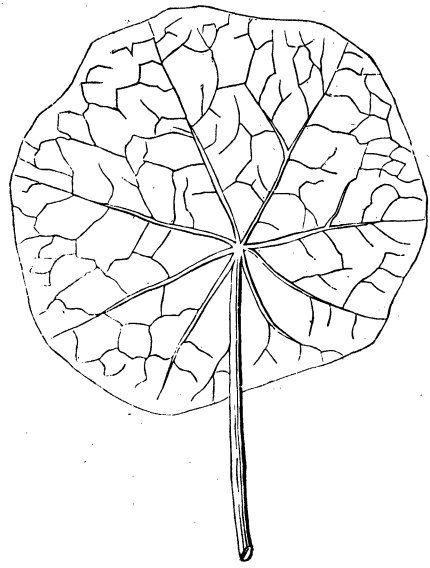
CORDATE.



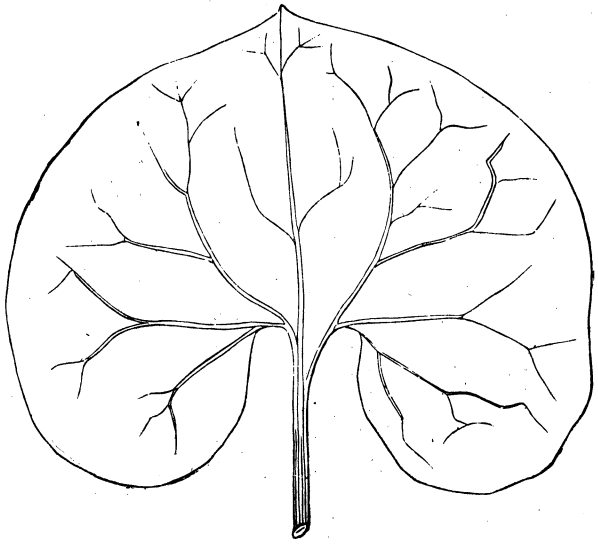
ARTICULATE.



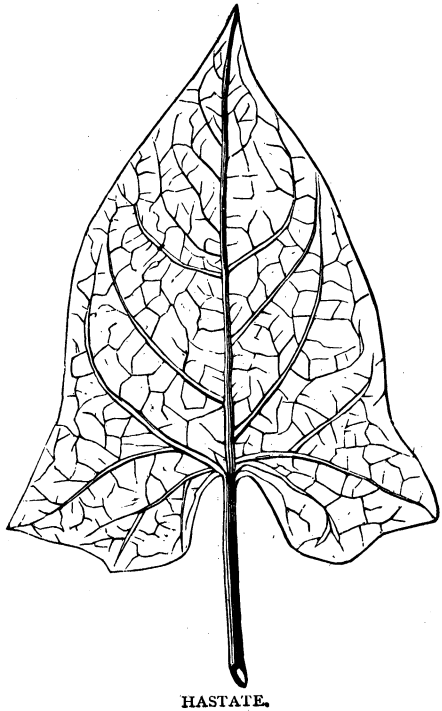
SAGITTATE.



PELTATE.

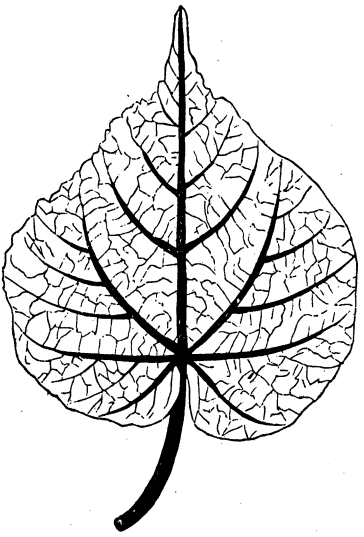


RENIFORM.

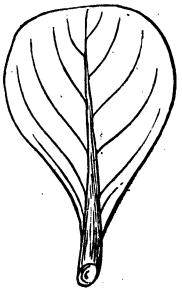


HASTATE.

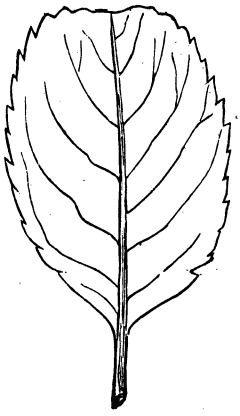
19. Here is a group, each named from the shape of the *top* or *apex:* Acuminate, Acute, Obtuse, Truncate, Retuse, Obcordate.



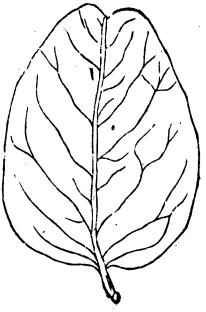
ACUMINATE.



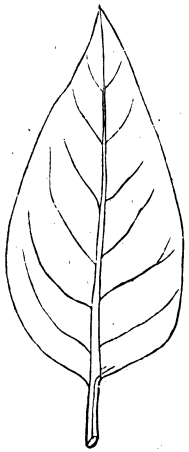
OBTUSE.



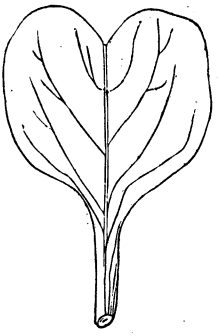
TRUNCATE.



RETUSE.

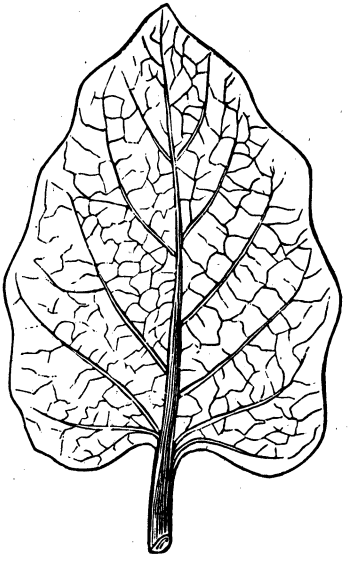


ACUTE.

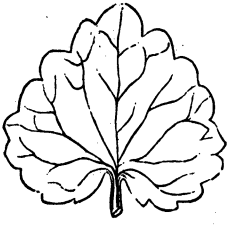


OBCORDATE.

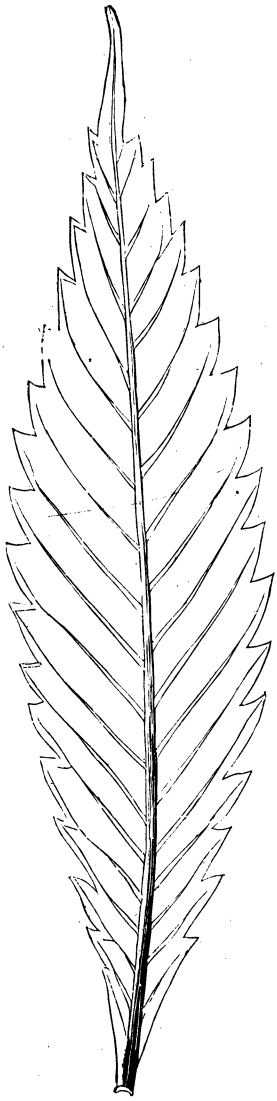
20. Here is a group, each named with reference to the shape of the *margin:* Entire, Serrate, Dentate, Repand, Sinuate, Incised.



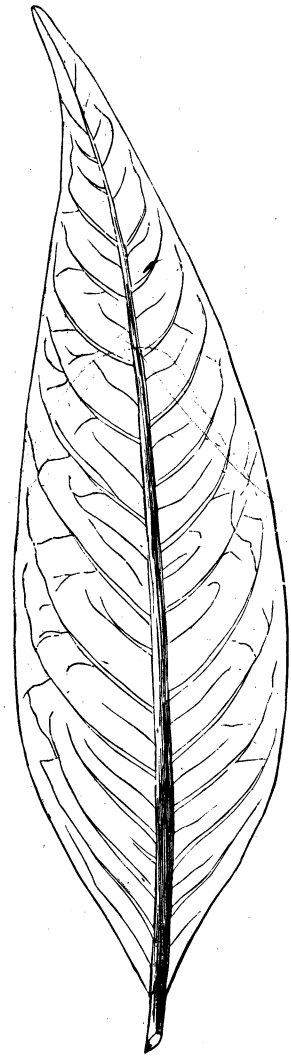
REPAND.



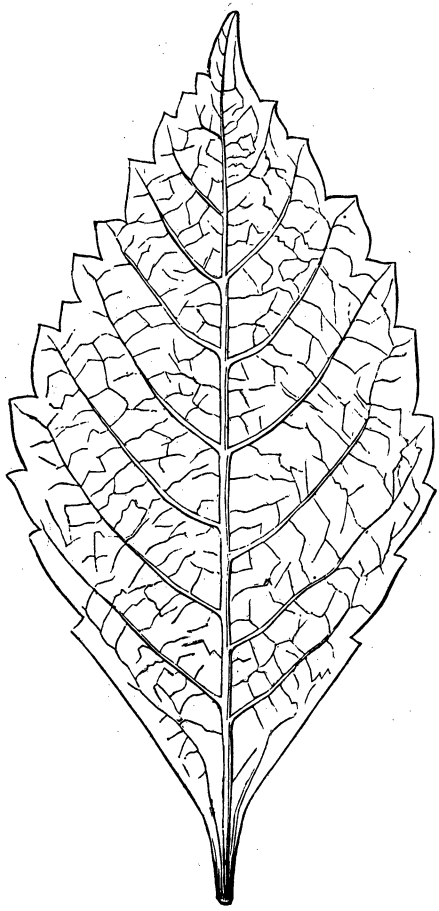
CRENATE.



SERRATE.



ENTIRE



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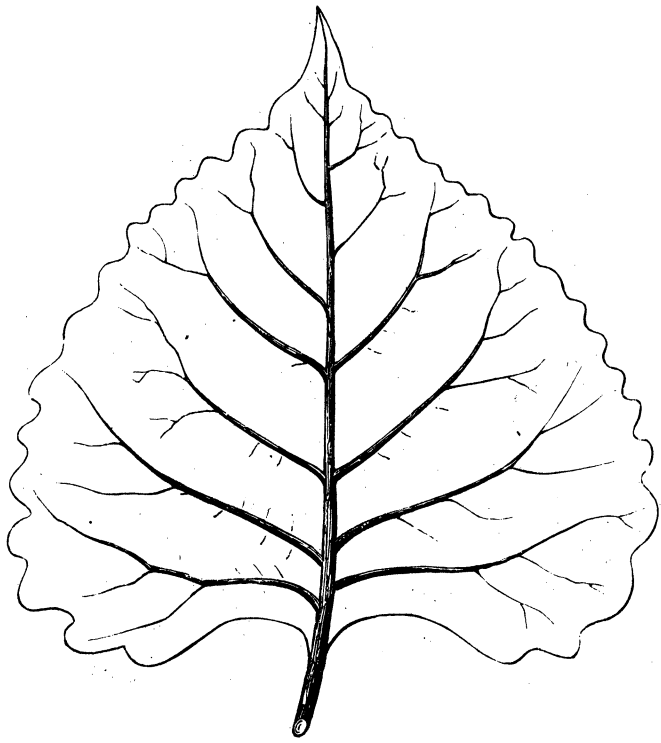

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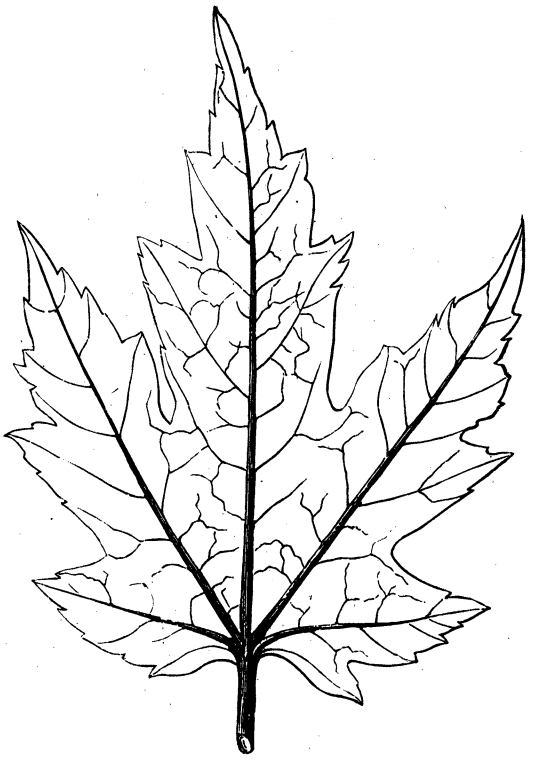
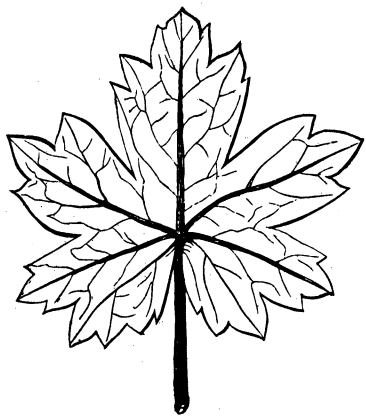
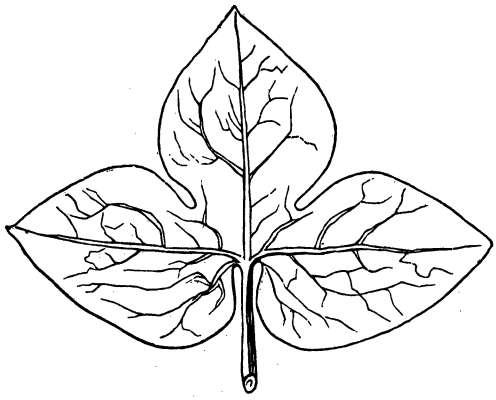


INCISED.

21. When the incisions in a leaf extend about half way to the middle, and are somewhat rounded, it is said to be **Lobed.** When the incisions extend more than half way, it is said to be **Cleft.**



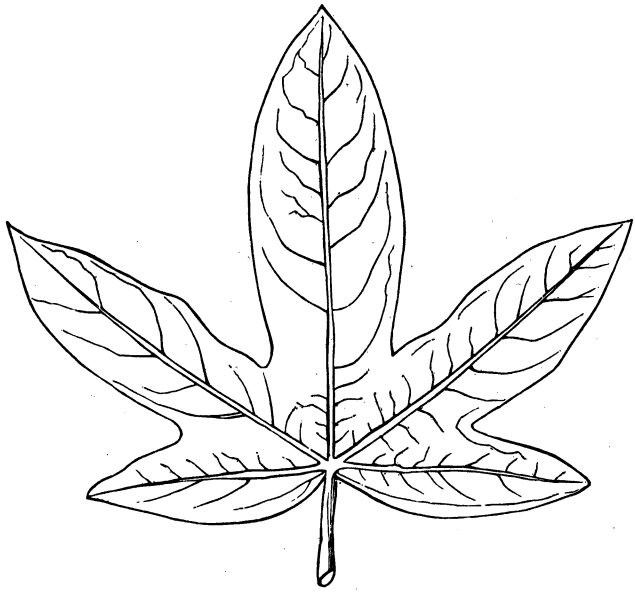
CLEFT.



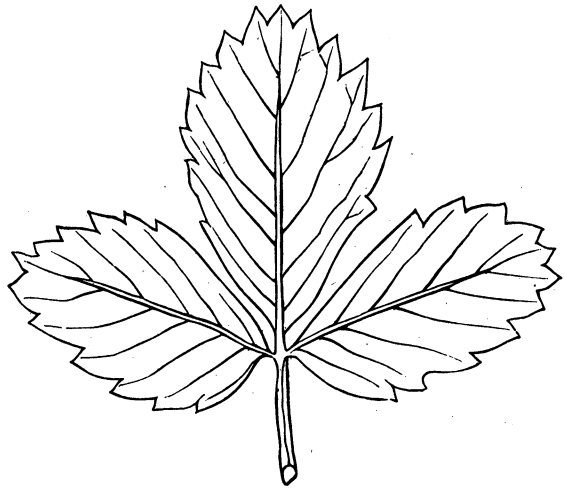
LOBED.

When the incisions extend almost to the midrib or to the base of the leaf, it is said to be **Parted.**

When the incisions extend quite to the midrib or to the base of the leaf, it is said to be **Divided.**

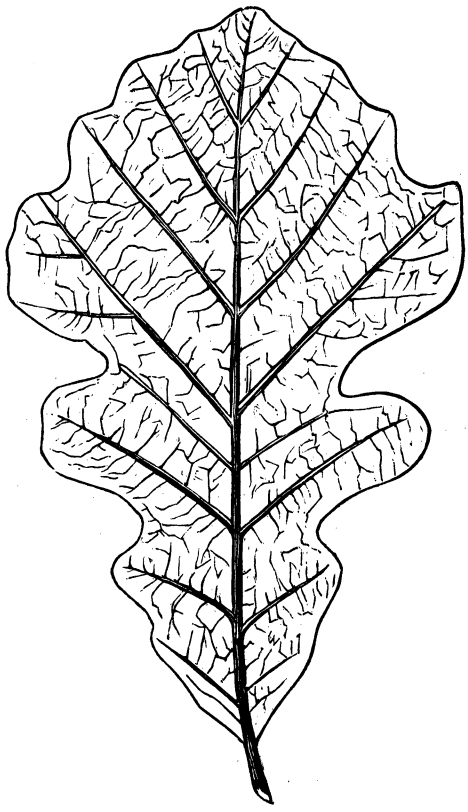


PARTED.

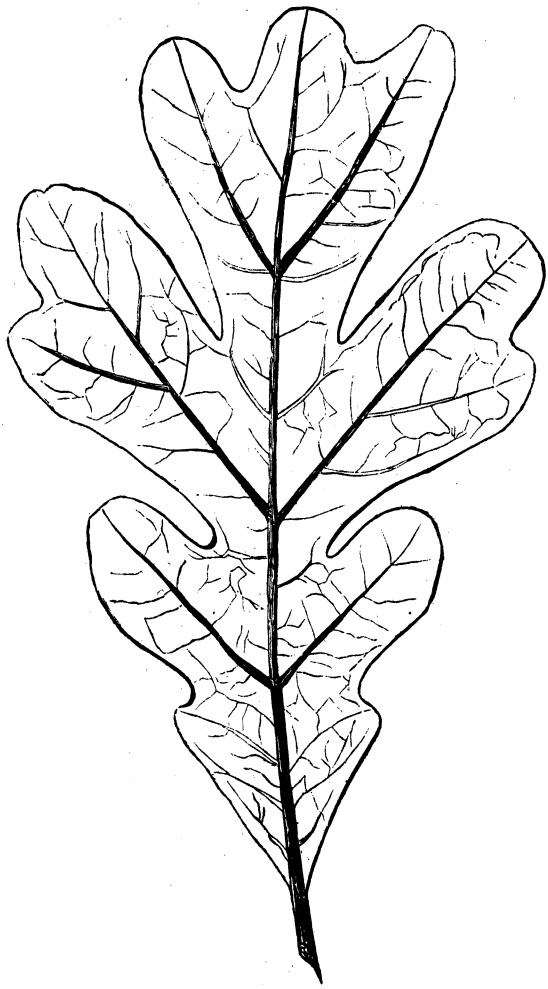


DIVIDED.

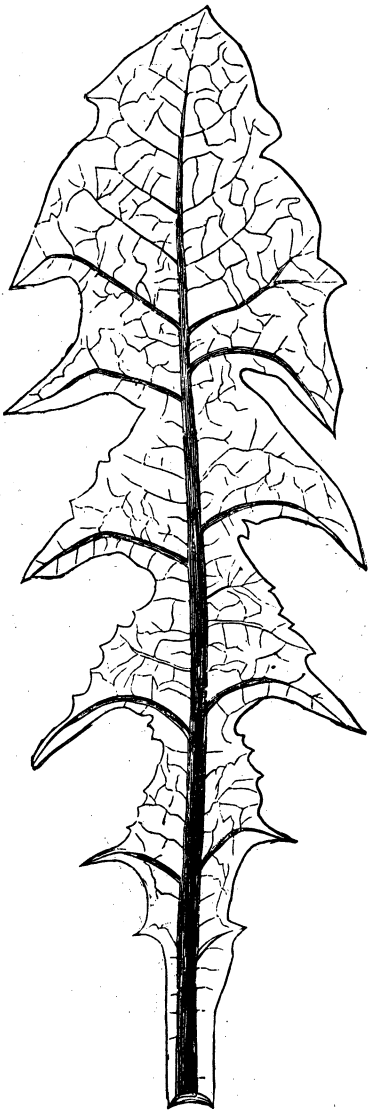
22. There are two kinds of net-veined leaves, you will remember; and each kind may be *lobed*, *cleft*, *parted*, or *divided*, as you will see in the Figures.



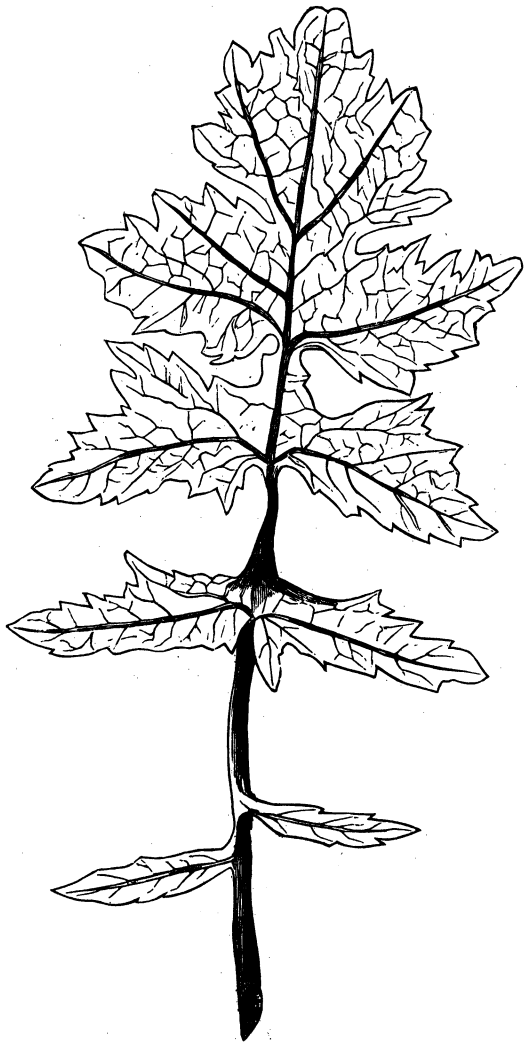
FEATHER-VEINED LOBED.



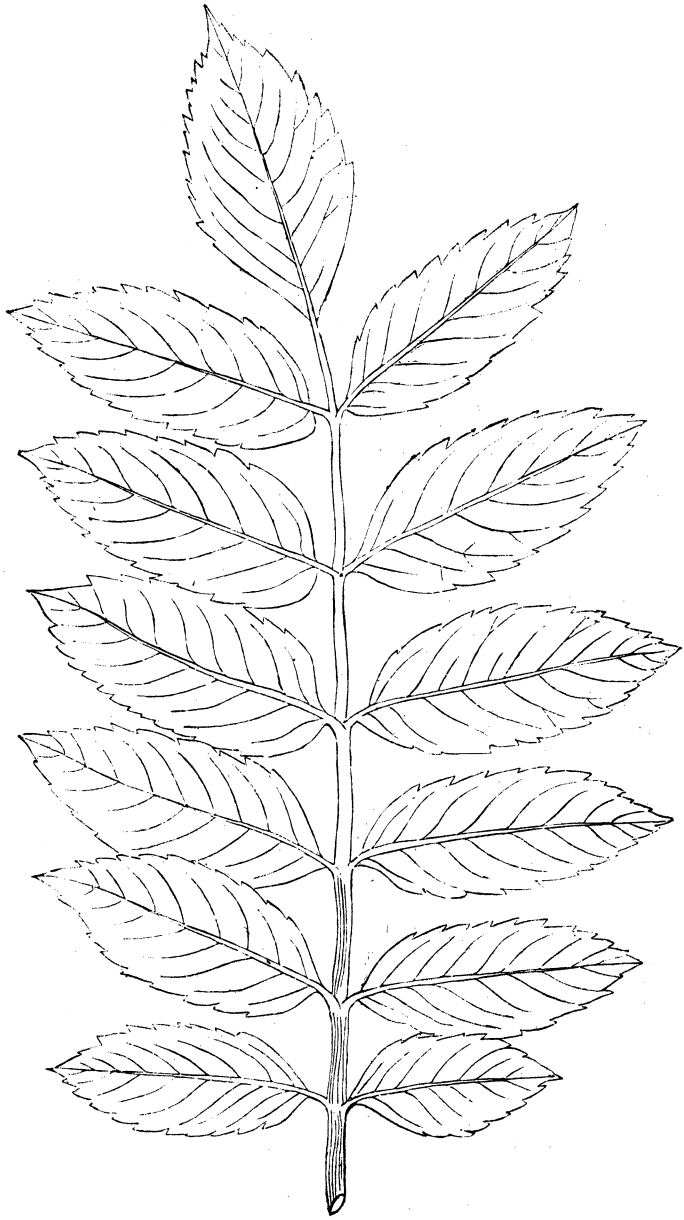
FEATHER-VEINED CLEFT.



FEATHER-VEINED PARTED.



FEATHER-VEINED DIVIDED.

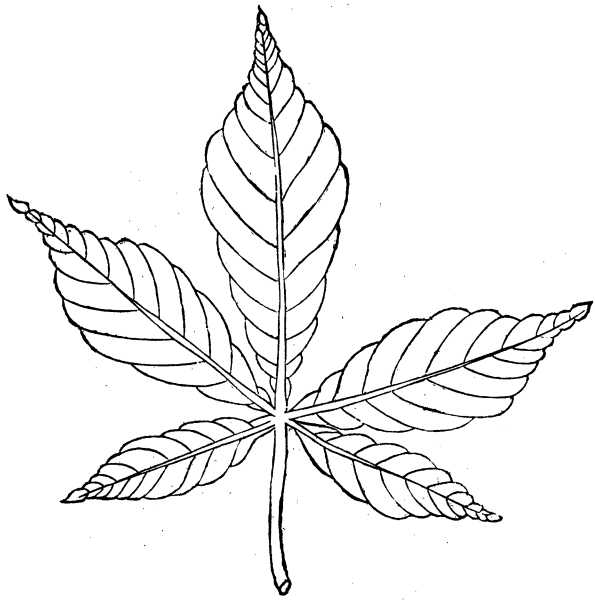


FEATHER-VEINED COMPOUND LEAF.

23. A **Compound Leaf** is one which has its blade in two or more entirely separate parts, called **Leaflets.** Compound leaves are of two kinds, *Feather-veined* and *Radiate-veined.*

Feather-veined leaves may be Lobed, Cleft, Parted or Divided.

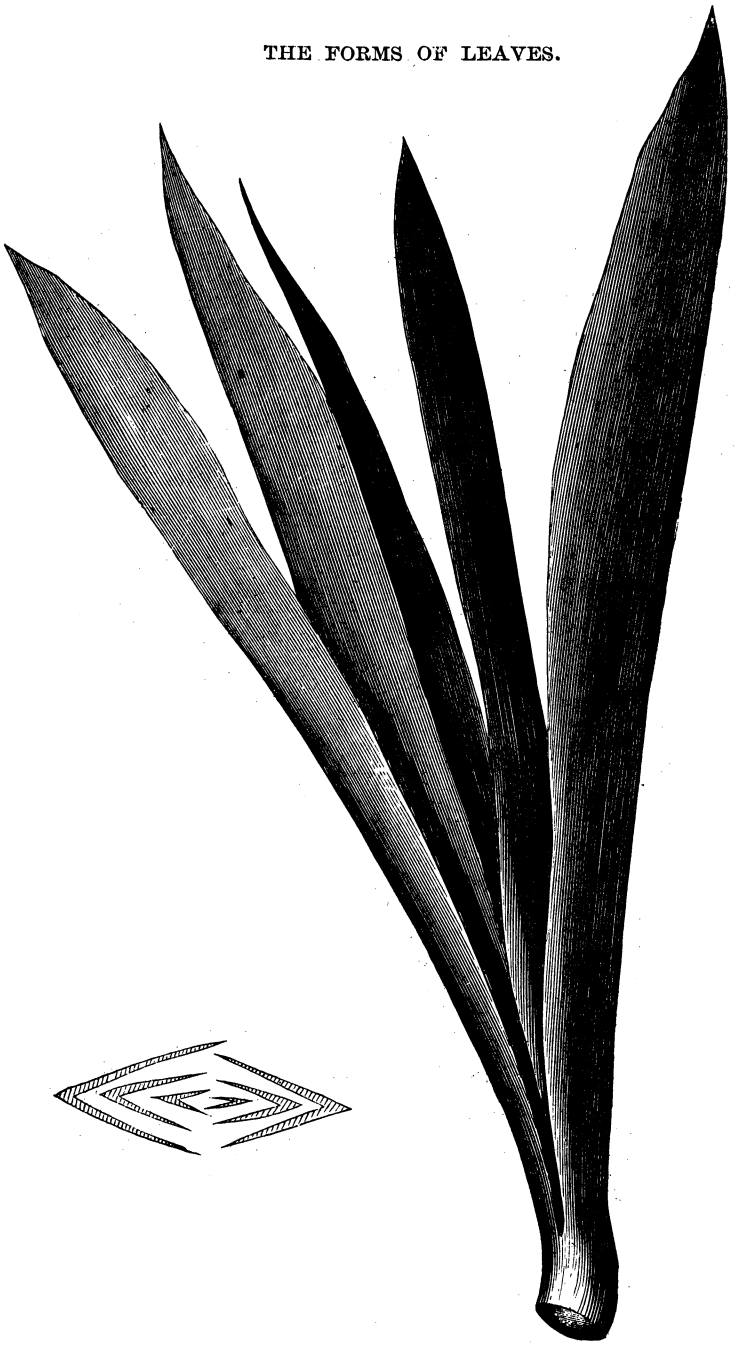
Radiate-veined leaves may be Lobed, Cleft, Parted or Divided.



RADIATE-VEINED COMPOUND LEAF.

24. In some plants the stem appears to run through the blade of the leaf, near one end. Such leaves are called **Perfoliate.**

PERFOLIATE LEAVES.



EQUITANT LEAVES.

25. The stem does not really run through the leaf, but the leaf clasps the stem, and the heart-shaped lobes of the base grow together and enclose the stem.

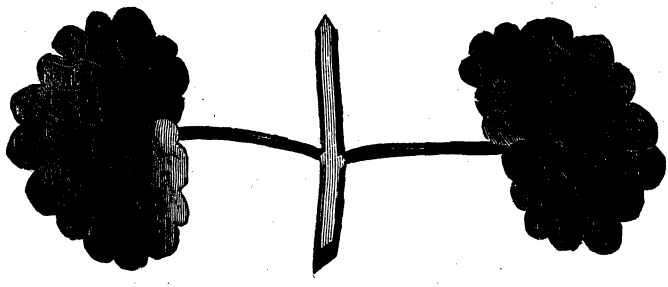
26. Such leaves as the Iris are called **Equitant.** They are each folded lengthwise in the middle, and are packed one over the other.

LESSON IV.

ARRANGEMENT OF LEAVES.

27. Leaves are arranged on the stem in some regular order. Different kinds or species of plants have different kinds of leaf-order, but the same kind or species always has the same leaf-arrangement.

28. When a stem bears two leaves on the same node, one is separated from the other by just one-half of the circumference of the stem, and the leaves are said to be **Opposite** or **Two-ranked.** The Indian Corn is a good illustration.



TWO-RANKED.

29. When only one leaf is found arising from a node, the leaves are said to be **Alternate.**

30. The simplest arrangement of alternate leaves is called the **Three-ranked**; that is, the leaves are separated by one-third of the circumference of the stem, and three leaves complete one cycle.

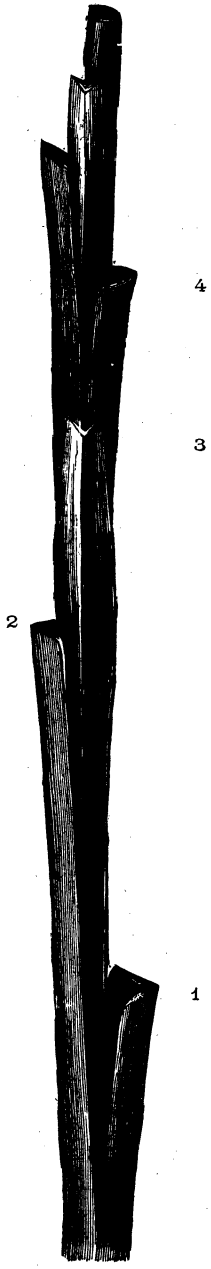
31. Beginning with any leaf on the stem, as (1) in the figure, the next above it (2) is found to be one-third of the circumference of the stem from (1); the next (3) is one-third of the circumference from (2), and two-thirds of the circumference from (1), the leaf at which we began to count; the next (4) is one-third of the circumference from (3), and three-thirds, or the whole circumference, from the leaf we began with.

32. We find that three leaves form a complete cycle, and that the fourth leaf stands directly over, or in a vertical line with, the first. The Alder and the Sedges are illustrations of the three-ranked cycle.

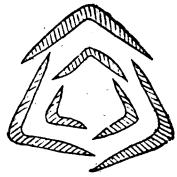
33. The $\frac{2}{5}$ arrangement is, perhaps, the most common. The Cherry, the Apple, the Peach afford illustrations of it. Here the leaves are two-fifths of a circumference from each other.

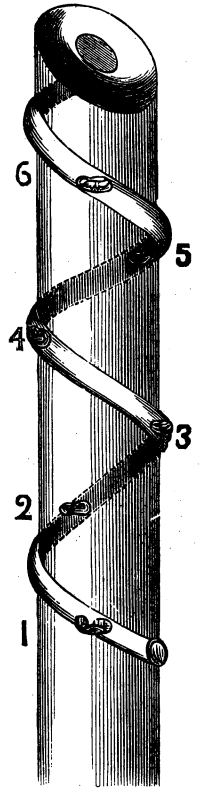
34. The next is the $\frac{3}{8}$ arrangement. Here the leaves are three-eighths of a circumference from each other. The Osage Orange is an illustration.

35. If we write in order the series of fractions which represent the simplest forms of leaf-arrangement that we have observed, viz., $\frac{1}{2}$, $\frac{1}{3}$, $\frac{2}{5}$, $\frac{3}{8}$, we observe that the numerator



THREE RANKED.





FIVE RANKED.

of the third fraction is the sum of the numerators of the first and second, and the denominator of the third is the sum of the denominators of the first and second. The numerator of the fourth is the sum of the numerators of the second and third, and its denominator the sum of their denominators. By applying this simple rule we may extend this series; thus, $\frac{1}{2}$, $\frac{1}{3}$, $\frac{2}{5}$, $\frac{3}{8}$, $\frac{5}{13}$, $\frac{8}{21}$, $\frac{13}{34}$, &c.

36. Each fraction in the above series tells us two things: First. How far distant, or what part of a circumference of the stem, one leaf is from another.

37. Second. The numerator tells us how many times we must pass around the stem to find a leaf directly over, or in a vertical line with, the first one taken; and the denominator tells us the number of leaves in the circle or circles passed. Thus, $\frac{2}{5}$, $\frac{4}{5}$, $\frac{6}{5}$, $\frac{8}{5}$, $\frac{10}{5}$, showing two cycles and five leaves; $\frac{3}{8}$, $\frac{6}{8}$, $\frac{9}{8}$, $\frac{12}{8}$, $\frac{15}{8}$, $\frac{18}{8}$, $\frac{21}{8}$, $\frac{24}{8}$, three cycles and eight leaves.

38. In the first of the above examples, we should pass around the stem twice, and find five leaves in the two cycles. In the second, we should pass around the stem three times, and find eight leaves in the three cycles.

LESSON V.

THE STEM.

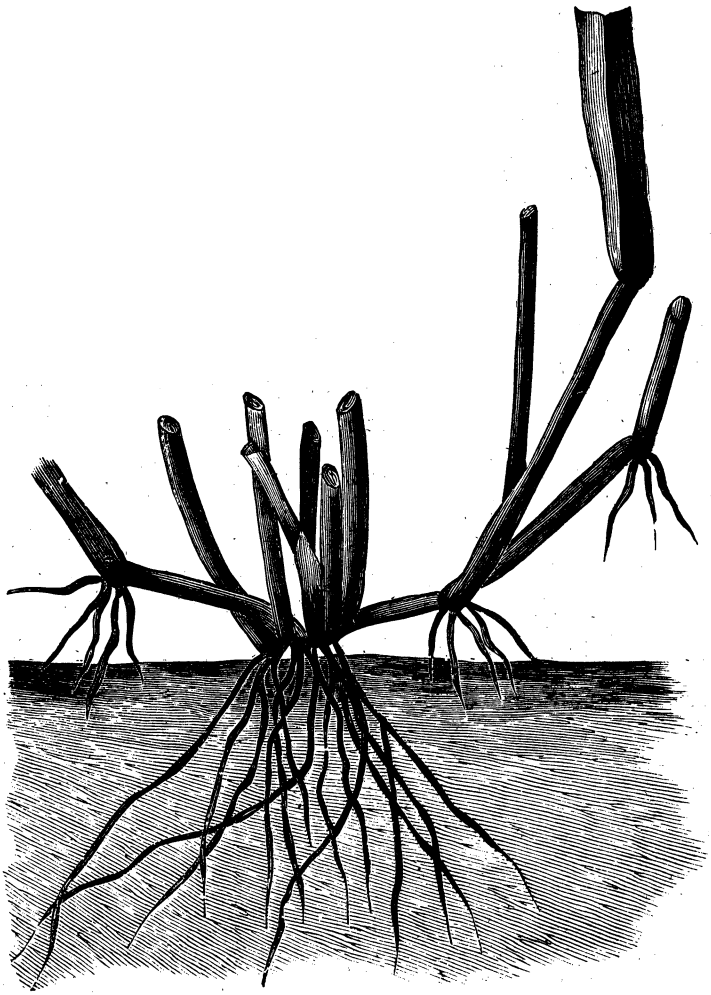
39. The growing points of the stem are called **Buds.**

A bud is a collection of leaves on a short stem or axis.

By expanding its leaves and lengthening the axis, a bud develops into a **Branch.**

40. When a bud grows upon the end of a stem, it is called **Terminal.**

STEM, WITH BUDS.



ROOT-STOCK.

When it grows in the axil of the leaf, that is, in the point where the upper surface of the leaf joins the stem, it is called **Axillary.**

41. When buds spring from any other part of the stem, they are called **Adventitious.**

42. When a tree or shrub is wounded or bruised, there will frequently appear a tuft or cluster of irregular shoots or branches; these come from adventitious buds.

43. The jointed stem of grasses and similar plants is called a **Culm.**

44. When the stem creeps along the ground or beneath its surface, it is called a **Root-stock.**

It develops a bud at its end every year, which grows, while the older portion of the root-stock decays.

The Mint and the Quick-grass are good examples.

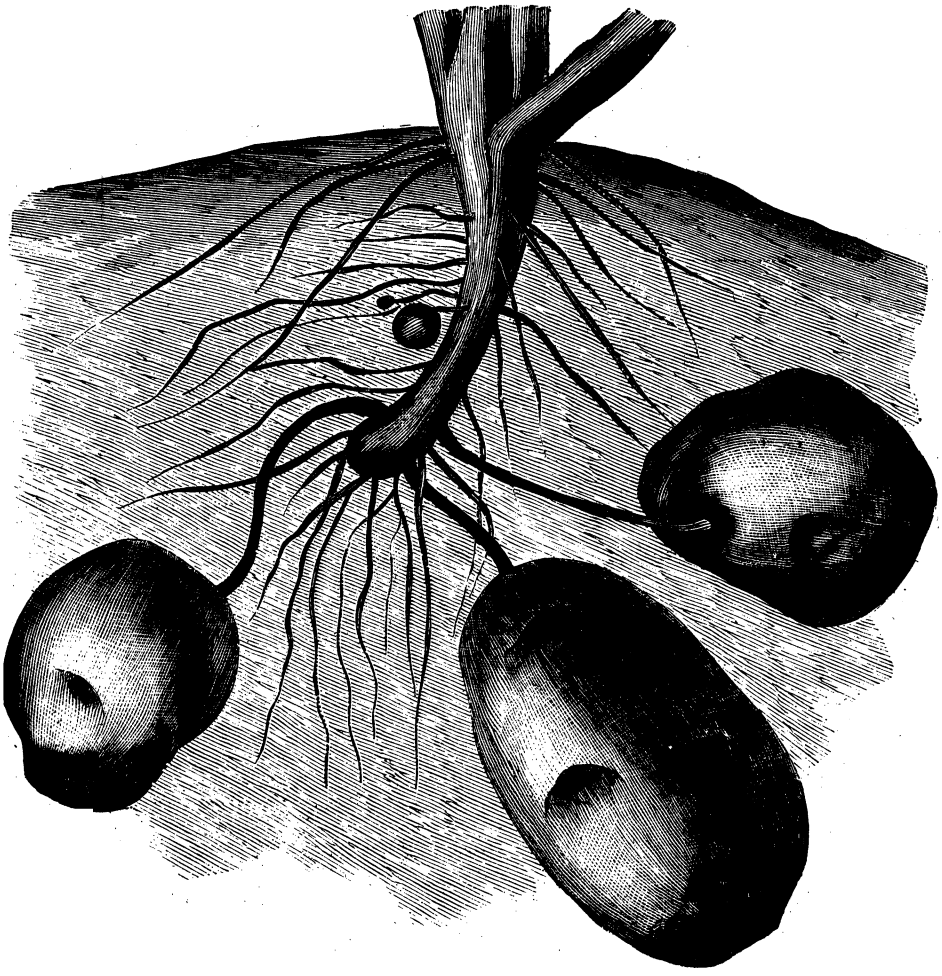
45. When a stem or branch grows under ground and becomes excessively thickened by a deposition of starchy matter, and is furnished with small scales having concealed buds (eyes) in their axils, it is called a **Tuber.**

The common Potato is a good example of the tuber.

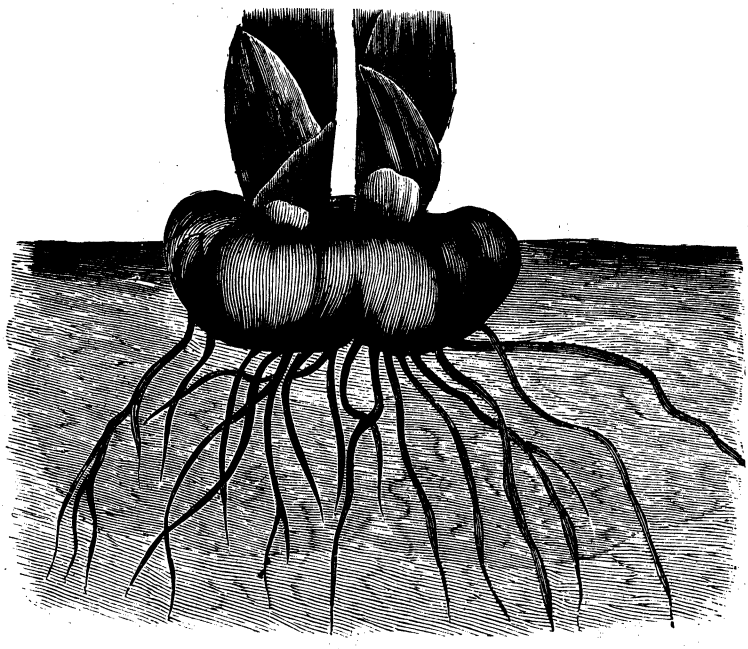
46. When an under-ground stem takes a solid, globular form, with buds at the top, and roots below, and is filled with starchy matter, it is called a **Corm.**

The Crocus is an example.

47. When an under-ground stem is short, and bears many thickened leaves upon it, so that it seems to consist mainly of these, it is called a **Bulb.**



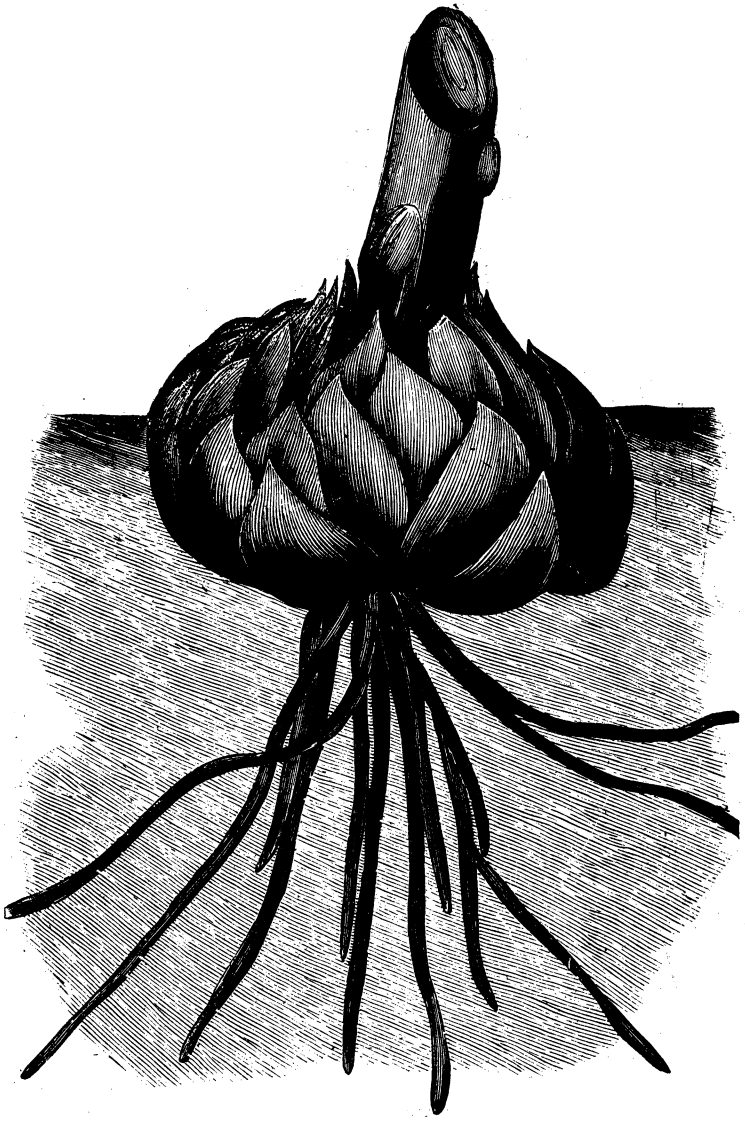
TUBER.



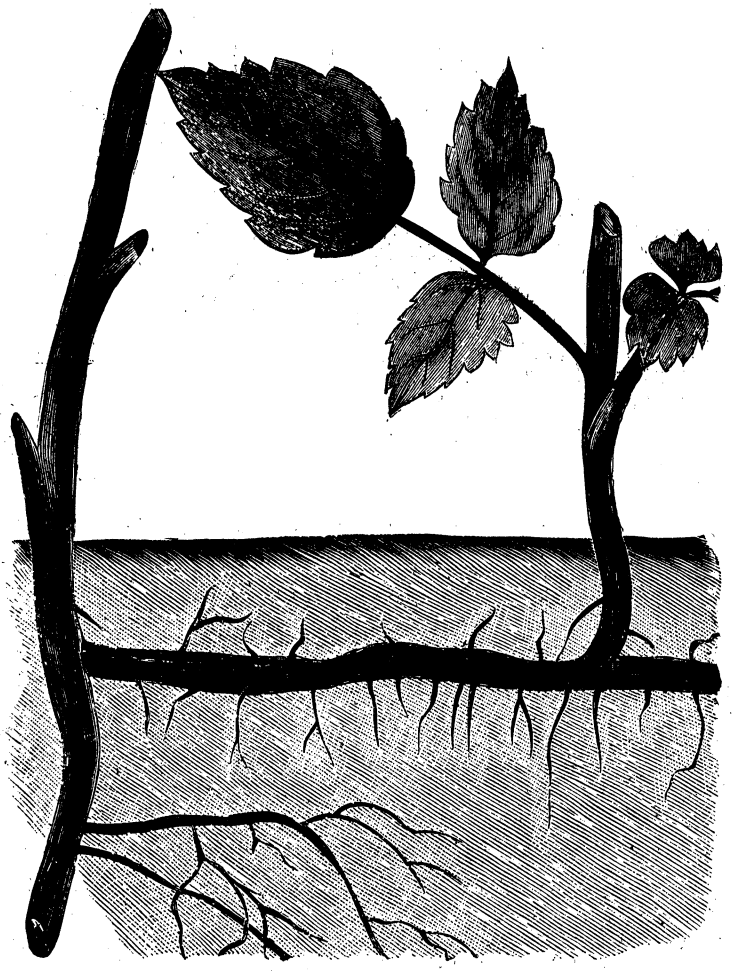
CORM.

If you compare the bulb of the Canada Lily with the strong buds of the Hickory, you will see that they are quite alike in structure.

48. Sometimes we find small bulbs above ground, in the axils of the leaves. Such are called **Bulblets.** You will find them on the Tiger Lily. They look like, and are sometimes called, seeds, but are really little bulbs.

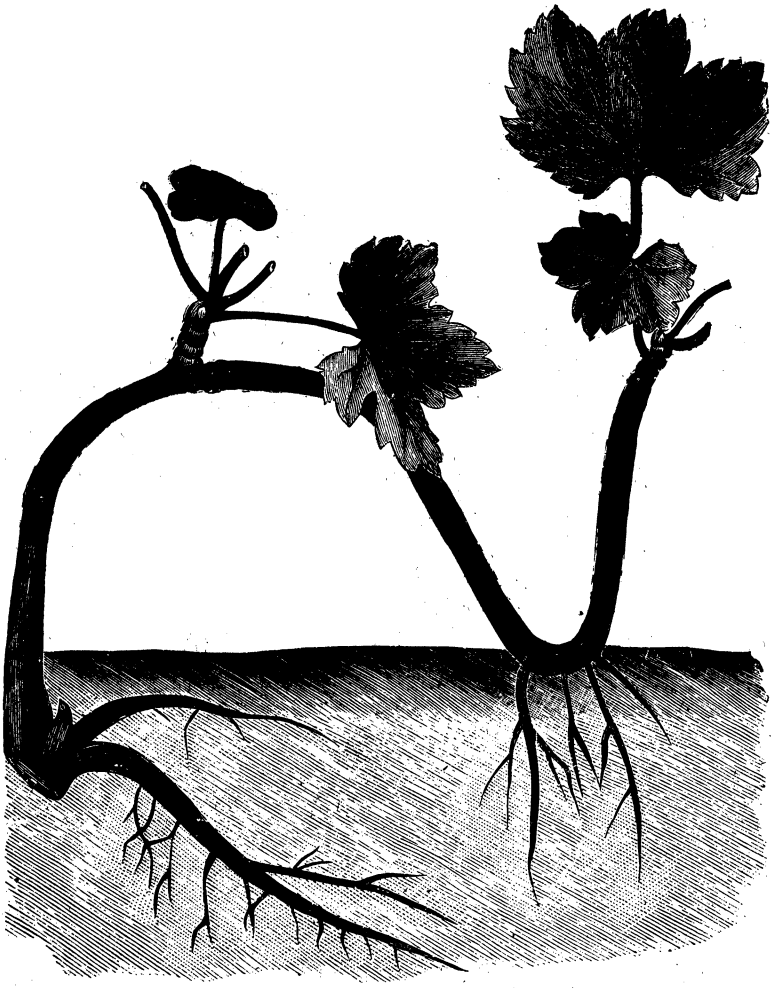


BULB.



SUCKER.

49. When a branch grows from an under-ground stem, it is called a **Sucker.** The Raspberry is an example.



STOLON.

50. When a branch trails, or runs along the surface of the ground, and takes root, and sends up a shoot, we call it a **Stolon.**

RUNNER.

51. A slender and leafless branch that takes root only at the tip, is called a **Runner.**

52. When a branch is slender and leafless, and tends to wind about something, to give support to the plant from which it grows, it is called a **Tendril.**

TENDRIL.

53. When a branch is stunted, hardened, leafless and pointed, it is called a **Thorn.**

54. Sometimes a thorn is a leaf. We can easily determine, however, by its place, whether the thorn is a branch or a leaf. If it is in the axil of the leaf it is a branch; if not, it is a leaf.

Branches of neglected apple or pear trees sometimes change into thorns.

The thorns of the Honey-Locust are developed from adventitious buds.

LESSON VI.

ROOTS.

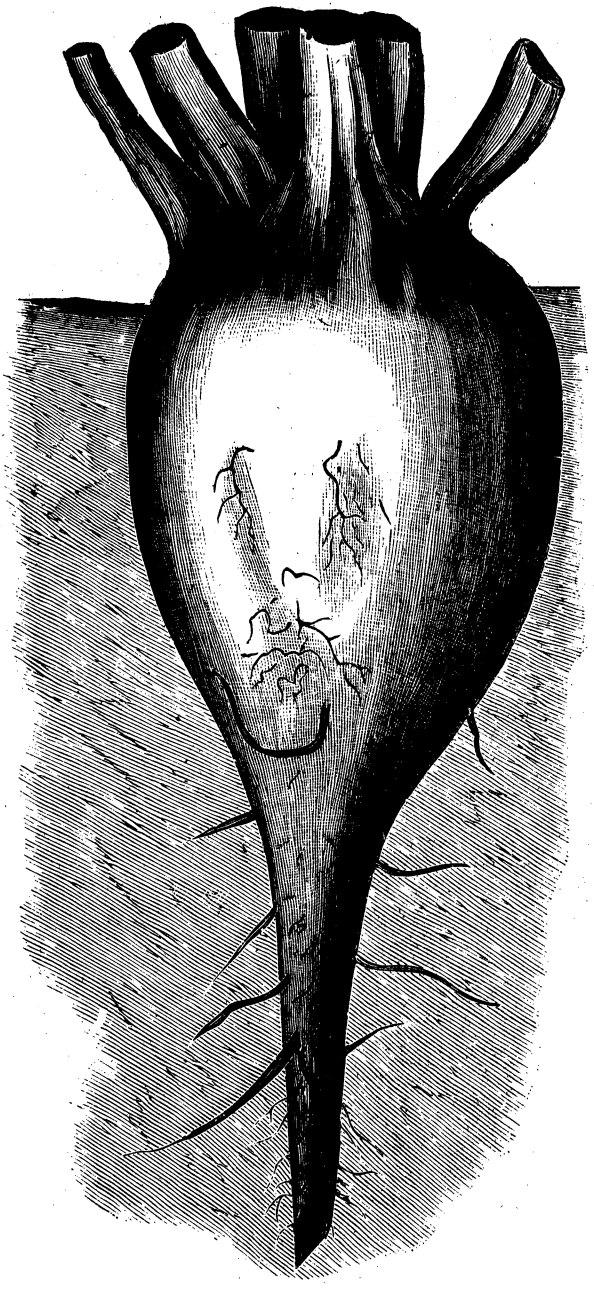
55. When a single root descends directly from the seed, it is called **Simple Primary.** The Beet is an illustration.

Roots that descend in a cluster from the seed are called **Multiple Primary.** The Onion is an illustration.

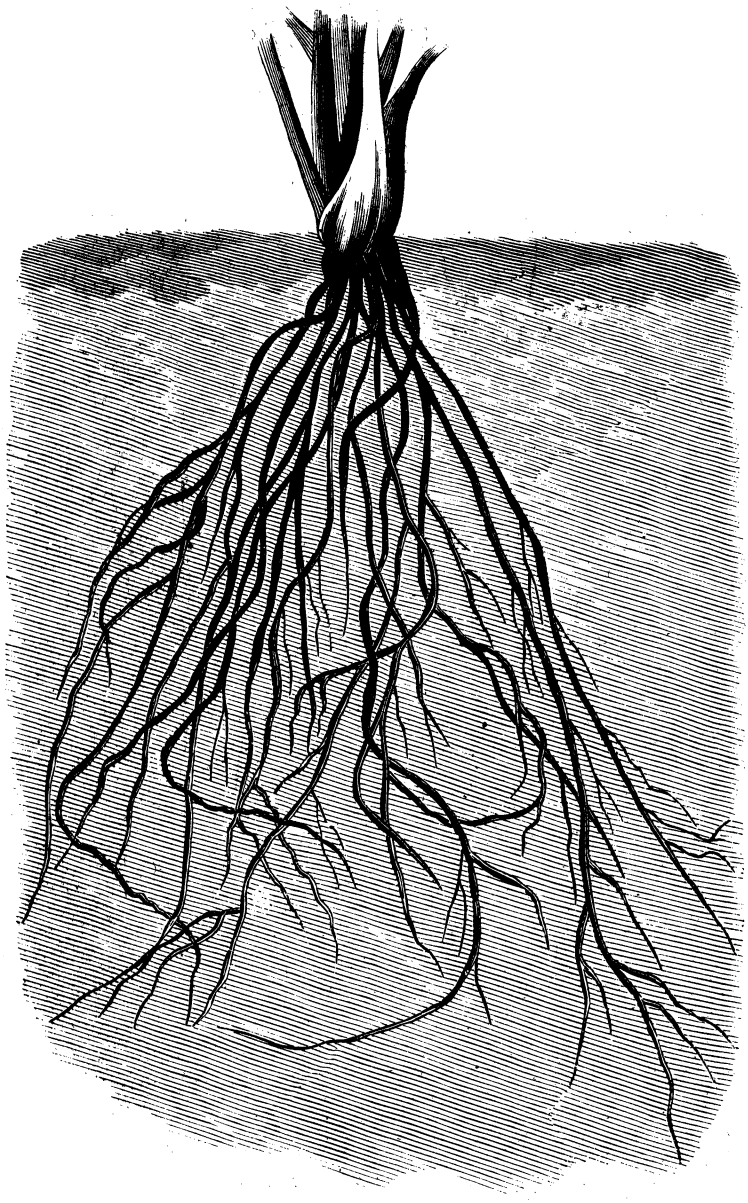
56. When roots grow from any part of the stem, they are called **Secondary.** The roots seen above ground on the corn-stalk are an illustration.

57. When a plant is borne on the trunk or branch of a tree, but derives its nourishment from the air, it is called an **Epiphyte** or **Air Plant.**

58. A plant which draws its nourishment from the juices of another, into whose trunk or branch it sends its roots, is called a **Parasite.** The Dodder is an illustration.



SIMPLE PRIMARY ROOT.



MULTIPLE PRIMARY ROOT.

LESSON VII.

THE FLOWER.

59. The **Flower** is a modified branch, consisting of stem and leaves, and is concerned in the production of seed. The flower stem is very short, and the leaves differ from the ordinary or foliage leaves in form and color.

60. Flowers are developed from terminal or from axillary buds. The same plant commonly produces both kinds of foliage buds, but it rarely bears flower buds in both situations; these are usually all terminal, or all axillary.

61. When all the flowers rise from axillary buds, the flowering is said to be **Indefinite**; because, while the axillary buds produce flowers, the terminal (foliage) bud grows on, and continues the stem indefinitely.

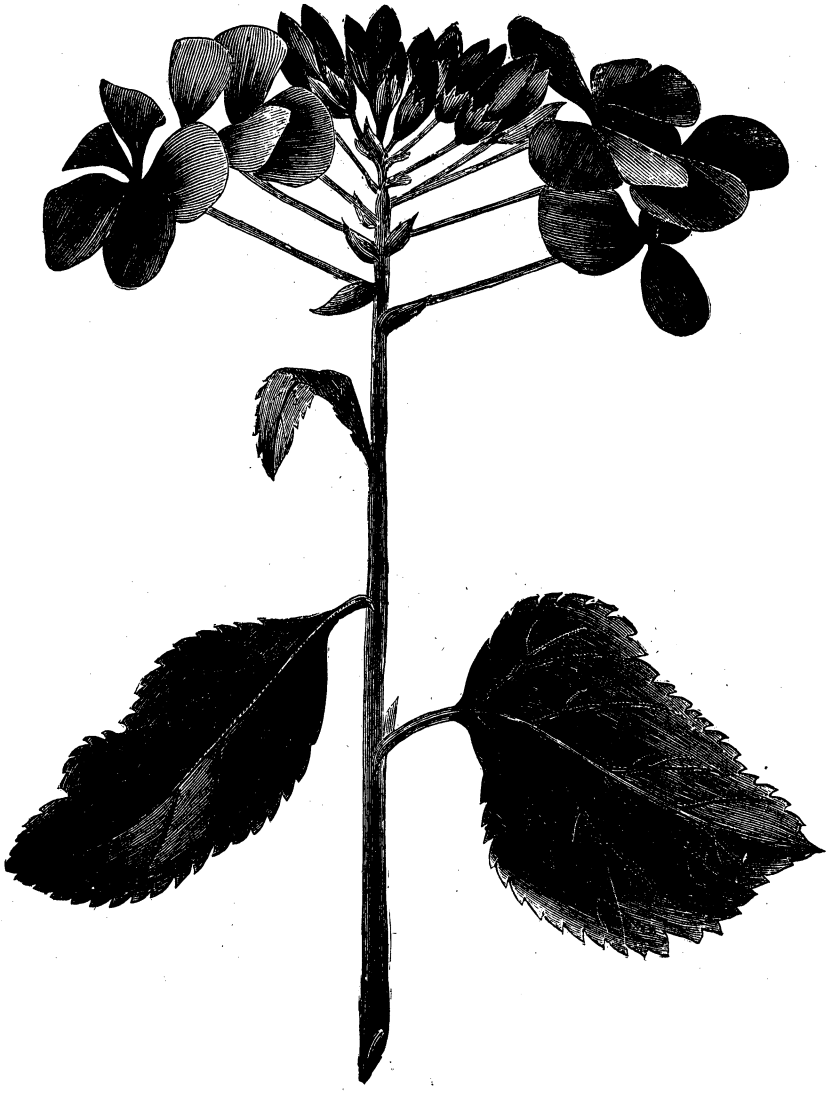
62. The stem of a flower is called the **Peduncle.** When a cluster of flowers is borne on a stem, the stem is called the **Common Peduncle,** and the stalk or stem of each particular flower is called the **Pedicel.**

63. If the flower has no stem it is said to be **Sessile.**

64. The leaves on the common peduncle are called **Bracts,** and those on the pedicels are called **Bractlets.**

65. A cluster of flowers borne on a common peduncle, and each flower having a pedicel, is called a **Raceme.**

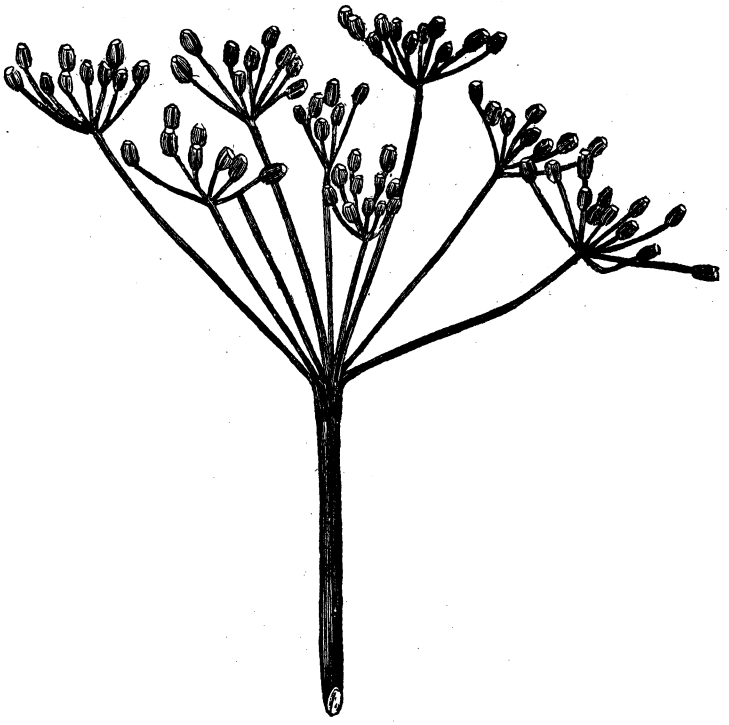
RACEME.



CORYMB.

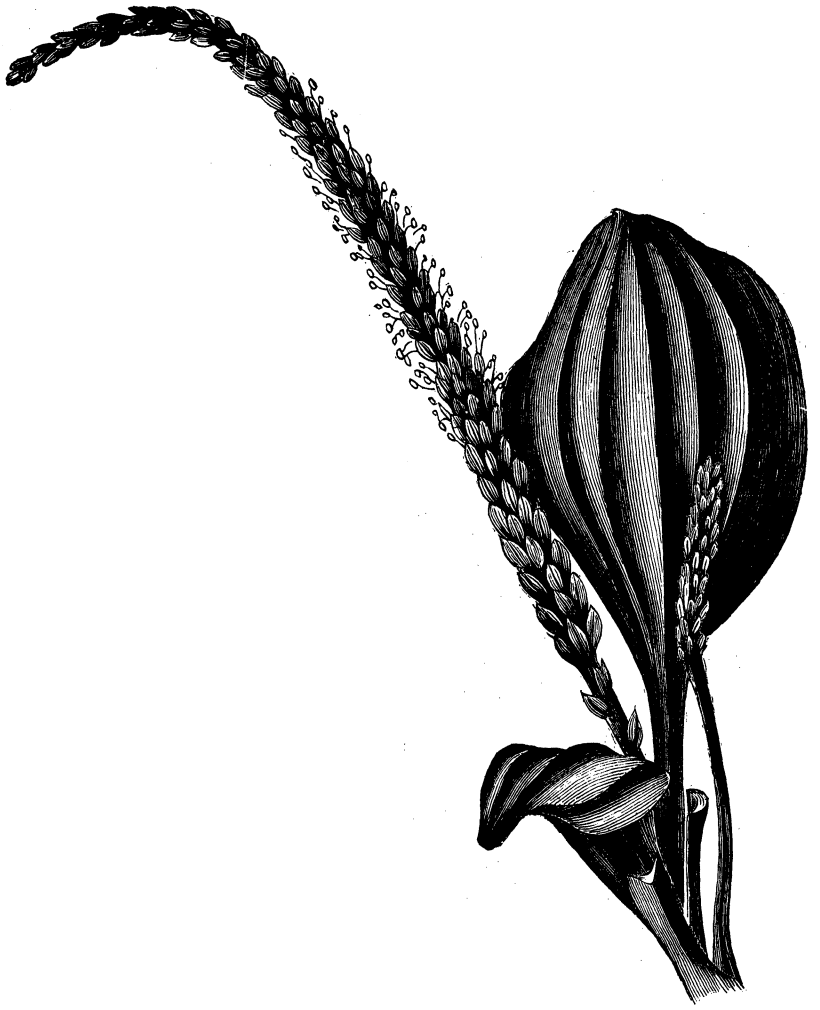
66. When the pedicels are unequal in length, the lower ones being longer than the upper, the cluster is called a **Corymb.**

UMBEL.



COMPOUND UMBEL.

67. When all the pedicels seem to spring from the *top* of the common peduncle, and are equal in length, the cluster is called an **Umbel.**

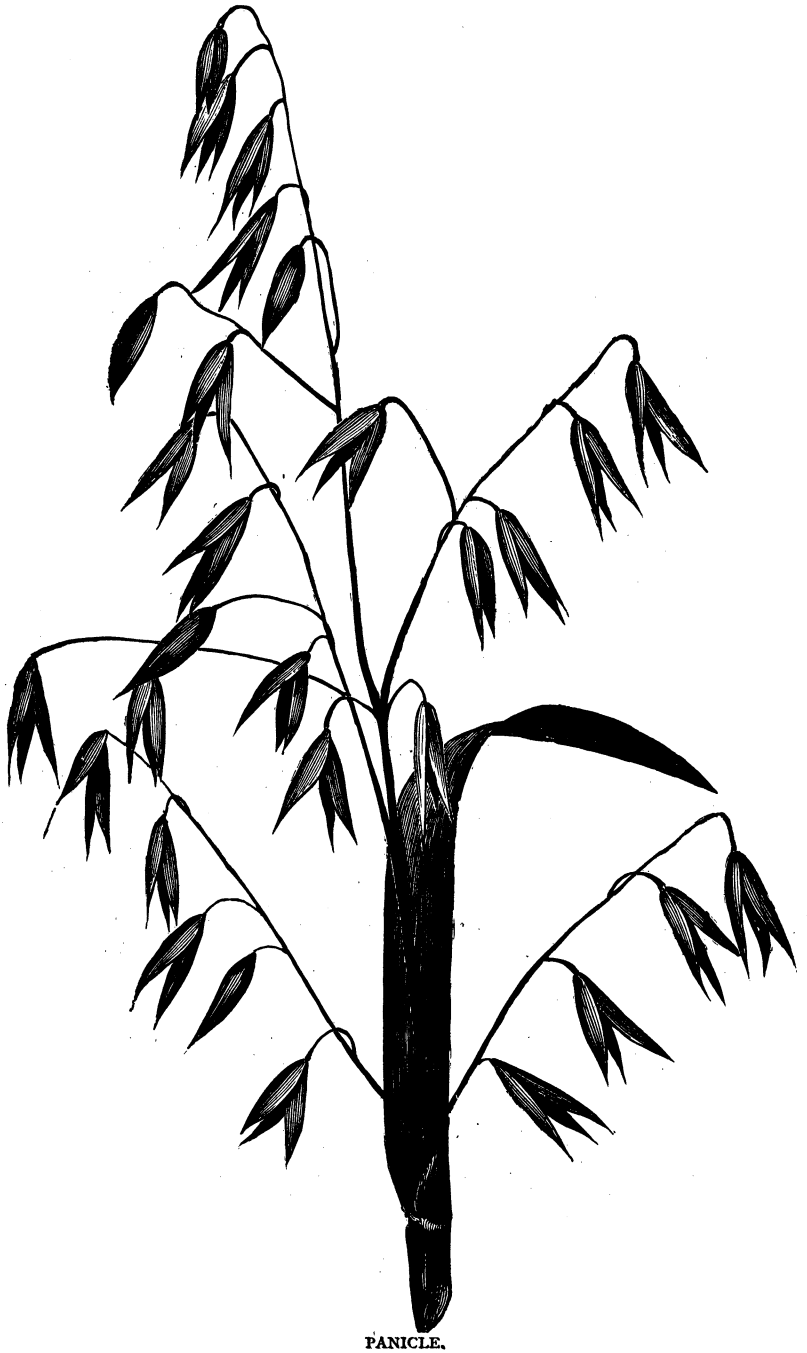


SPIKE.

68. When flowers are sessile on a common peduncle, as in the Mullein and Plantain, the cluster is called a **Spike.**

HEAD.

69. When flowers are sessile on a short and rounded peduncle, as in the Clover, the cluster is called a **Head.**



PANICLE.

CYME.

70. Flower clusters like those of the Oak, the Willow, the Poplar, are called **Catkins.**

71. The name **Panicle** is given to a raceme having branches which bear flowers.

72. When flowers are developed from terminal buds, the flowering is said to be **Definite.** In the simplest form of definite flowering, the terminal bud develops into a flower and terminates the growth of the stem.

73. When a flower rises from the terminal bud of the main stem, and others from the terminal buds of the branches of this stem, the cluster is called a **Cyme.** It will be observed that the *order* of flowering in the cyme is the reverse of that of the raceme. The former has flowers at the top, and buds below; while the latter has buds at the top, and flowers below.

74. When the flowers are much crowded, as if into a bundle, the cluster is called a **Fascicle.**

75. When the flowers are crowded into a compact head, the cluster is called a **Glomerule.** The glomerule may be known from the head, by the fact that in the head the buds are found at the top, and the flowers below; while in the glomerule the flowers are found at the top, and the buds below.

LESSON VIII.

THE PARTS OF THE FLOWER.

76. The parts of the flower that are necessary to the production of seeds are called the **Essential Organs.** The other parts are called the **Floral Envelope.**

77. The floral envelopes in a complete flower are double; that is, they consist of two circles of leaves, one above or within the other.

78. The outer usually consists of green or greenish leaves, and is called the **Calyx.**

79. The inner set, which is usually of a more delicate texture, and some other color than green, forms, in most cases, the most showy part of the flower, and is called the **Corolla.**

80. Each leaf or separate piece of the corolla is called a **Petal**; each leaf of the calyx, a **Sepal.**

81. The essential organs are of two kinds, placed one above or within the other. The lower or outer ones, which bear a peculiar yellow dust called **Pollen,** are the fertilizing organs, and are called **Stamens.** The upper or inner ones, which are to be fertilized and to bear the seeds, are called **Pistils.**

82. Considering the flower as a branch, the lowest leaves are called sepals; the next are called petals; the next,

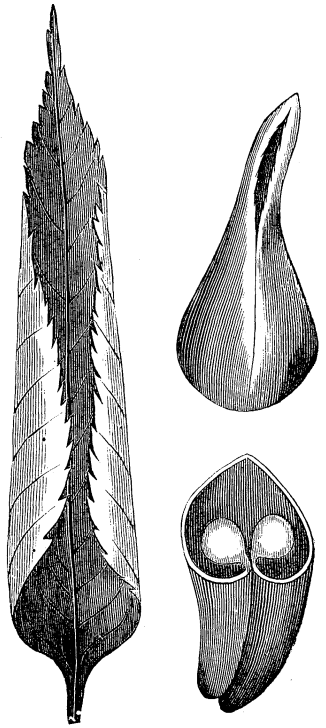
stamens; the highest, pistils. All these are borne on a short stem, called the **Receptacle.**

NOTE. It would be well for the teacher to explain to the pupils that, though the sepals, petals, stamens and pistils, especially the two latter, do not appear like leaves, still they are forms of leaves.

Take a leaf from a book and roll it into the form of a hollow cylinder: it is still a leaf. Roll it into a solid cylinder and flatten one end: it is still a leaf. Color it yellow, red or blue; and it is still a leaf.

So in the flower: the leaves assume peculiar shapes and colors, yet they are truly leaves.

83. The Stamen has two parts. The upper and expanded part that bears the pollen is called the **Anther.** The stalk that bears the anther is called the **Filament.**



SIMPLE PISTIL.

84. The Pistil consists of three parts. The lower part is a hollow case containing immature seeds (ovules), and is called the **Ovary.** The tapering part above the ovary is called the **Style.** The top of the style is naked (that is, has no covering of epidermis), and is called the **Stigma.**

It is upon the stigma that the pollen falls; and the result is, that the ovules contained in the ovary are fertilized and become seeds.

85. Sometimes the filament is wanting: then the anther is sessile. Sometimes the style is absent: then the stigma is sessile. So the filament and style are not essential parts.

LESSON IX.

THE PLAN OF THE FLOWER.

86. The **Flower,** like every other part of the plant, is formed upon a plan, which is essentially the same in all blossoms.

If we understand this *plan*, the almost endless varieties which different flowers present will be understood.

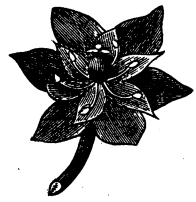
87. When a flower has both kinds of essential organs, stamens and pistils, it is called **Perfect.**

88. When a flower has all the parts, calyx, corolla, stamens and pistils, it is called **Complete.**

89. If all the parts of each set in a flower are alike in size and shape, it is called **Regular.**

90. When the stamens and pistils are in separate blossoms, that is, one sort of flowers has stamens but no pistils, and another has pistils but no stamens, the flower is called **Imperfect.**

IMPERFECT FLOWER.



PERFECT FLOWER.

91. The blossom which bears stamens is called a **Staminate** or **Sterile** flower, and the one that has pistils is called a **Pistilate** or **Fertile** flower.

92. When both kinds of flowers grow on the same plant, it is said to be **Monœcious.**

93. When only staminate blossoms are found on one plant, and only pistilate blossoms on another, the flowers are said to be **Diœcious.**

94. If the calyx or corolla is missing, the flower is said to be **Incomplete.** If both calyx and corolla are missing, the flower is said to be **Naked.**

95. When all the parts of the same set in a flower are of different forms, it is called **Irregular.**

IRREGULAR FLOWERS.

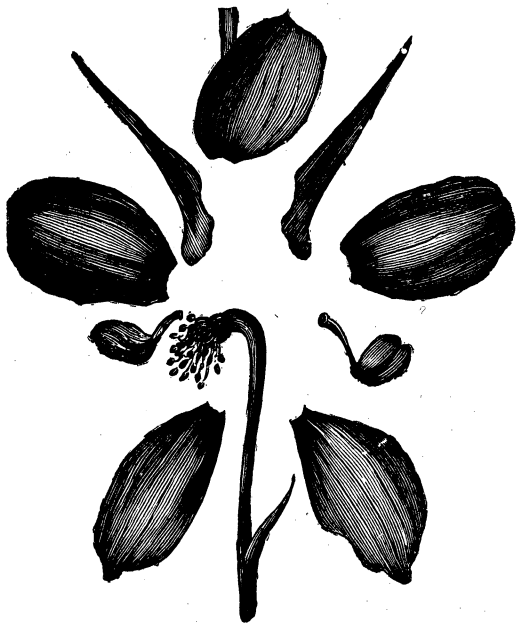
96. When in a flower, different sets of organs (particularly sepals and petals) do not agree in the number of their parts, we call the flower **Unsymmetrical.**

97. The Spring Beauty is an unsymmetrical flower, having two sepals and five petals. The Mustard, like all the flowers of that family, is both unsymmetrical and irregular; the flower has six stamens and four petals, making

it unsymmetrical, and as four of the stamens are long and two short, it is irregular.

98. Sometimes the plan of the flower is more or less obscured, either by **Abortive Organs** or by mere vestiges of parts. In the flower of the Catalpa, the plan is five stamens; but we almost always find only two perfect ones; the others are vestiges, which seem to stand there merely to tell us what the plan is.

99. Sometimes the plan of the flower is obscured more or less by an increase in the number of parts. The Buttercup, for instance, has five sepals and five petals, but many stamens and pistils. Botanists, however, regard the Buttercup as built upon the plan of five.



IRREGULAR FLOWER IN PARTS.

LESSON X.

THE FORMS OF THE FLOWER.

100. It will be remembered that when we were studying the stem, we found many forms of it. The trunk and branches of a tree, the stalk of an herb, the trailing vine, the straw of Wheat or grass, the slender runners of the Strawberry, the tendrils of the Grape, the tubers of the Potato, we learned, were forms of stem.

101. So we have observed that certain buds which might have grown and lengthened into leafy branches, do, under other circumstances, and to accomplish other purposes, develop into blossoms.

102. In these the axis or stem remains short, nearly as it is in the bud; the leaves, therefore, remain close together in sets or circles, the outer or lower ones, which constitute the calyx, generally appearing more or less like the ordinary foliage leaves.

103. The leaves of the next set above are more delicate, and are usually more highly colored, while the next sets, the stamens and pistils, appear in forms very different from those of ordinary leaves, and are concerned in the production of seed.

104. Again, flowers and branches arise from the same places, or have the same position. Flower-buds, like leaf-buds, appear either on the top of the stem, that is, as a terminal bud, or in the axil of a leaf, as an axillary bud. Fur-

thermore, it is quite impossible at an early stage to tell whether the bud is to give rise to a blossom or to a branch.

105. The sepals and petals are called by persons who are not botanists, the leaves of the flower.

106. The calyx is generally green, leaf-like; and though the corolla is rarely green, yet, neither are the *foliage* leaves always green. In some plants, such as the wild Painted Cup, the leaves are of the highest scarlet, while the corolla is a pale yellow.

107. In some plants there is such a regular gradation from the foliage leaves to those of the calyx, that it is quite impossible to say where the one ends and the other begins.

108. Sepals, then, are leaves. So also are petals; for there is, in many instances, no clearly fixed limit between them.

109. The calyx or the corolla often takes the form of a cup or a tube, instead of being in separate pieces. The same thing takes place with ordinary foliage leaves of many plants; for instance, those of the Honeysuckles.

110. When flowers are cultivated, they sometimes become **Double**; that is, they change their stamens into petals. Even some wild and natural flowers do the same thing.

111. The white Water Lily exhibits complete gradations, not only between sepals and petals, but between petals and stamens.

The sepals of this flower are green outside, and white and petal-like on the inside. The petals, which are in many rows,

WATER-LILY.

generally grow narrower towards the center of the flower. Some of these are found to be tipped with a trace of a yellow anther. The next are still more stamen-like, being narrower and with a flat filament; and this narrowing continues until we have a simple stamen.

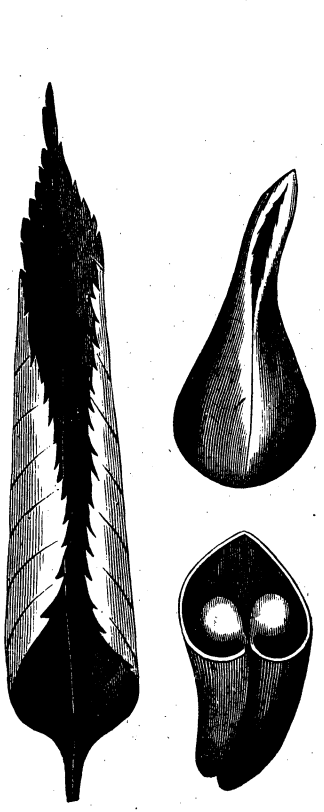
112. Pistils often turn into petals in cultivated flowers, and, in the Double Cherry, they sometimes change into small green leaves. Sometimes a whole blossom changes into a cluster of green leaves, and sometimes it becomes a leafy branch.

113. From all these facts, we must conclude that the flower is a branch consisting of stem and leaves.

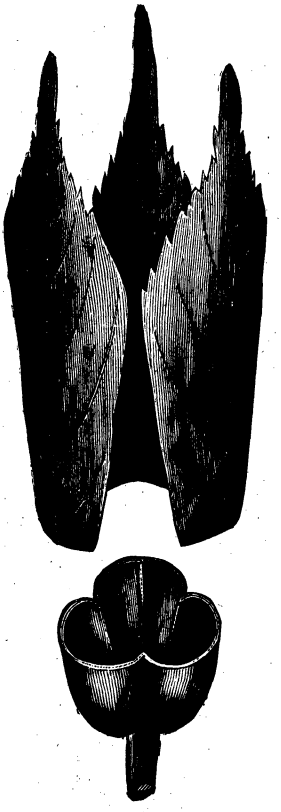
LESSON XI.

THE PISTIL.

114. The pistil is, in a certain sense, the most important part of the flower; for, while all the other parts fall off or wither away, the pistil remains, and its ovary contains the seeds that are to produce plants another time.



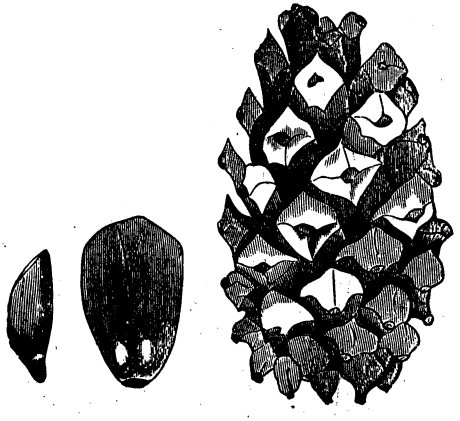
SIMPLE PISTIL.



COMPOUND PISTIL.

115. As we have before shown, a **Simple Pistil** answers to a leaf. When two or more leaves are combined to form a pistil, it is called **Compound.**

116. The cone of the Pine or of the Spruce is a collection of thick, scaly, open pistils. Each scale or leaf is a pistil; and the seeds—usually two—are borne at the base on the upper side of the cell or leaf. This is perhaps the simplest of all the pistils; that is, it is in some particulars most like an ordinary leaf.



CONE AND SEEDS.

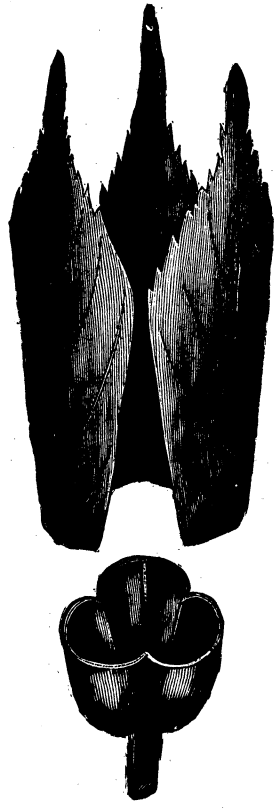
117. Usually, however, the simple pistil consists of the blade of a leaf curved until the edges meet and unite, forming a closed case, which is the ovary.

118. That the closed pistil is a leaf rolled up, is shown by the fact that the pistil of the Double-flowering Cherry is sometimes found changed back again into a small green leaf, partly folded, as seen in the Figure.

119. The line or seam down the inner side, which answers to the united edges of the leaf, and bears the seeds or ovules, is called the **Inner** or **Ventral Suture.**

120. The line or seam down the back of the ovary, and which answers to the midrib of the leaf, is called the **Outer** or **Dorsal Suture.** These sutures may be seen in the common Pea pod.

121. The seeds are always borne on the ventral suture, that is, on the edges of the leaf or leaves that make up the pistil.



COMPOUND PISTIL.

122. A simple pistil can have but one cavity or cell, while a compound pistil (one made up of more than one leaf) may have but one cell, or it may have as many as there are leaves. Three leaves may unite to form one cell, or they may so unite as to form three cells, as seen in the Figures

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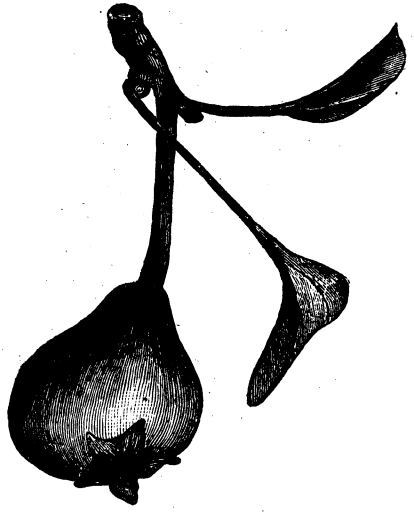
LESSON XII.

THE FRUIT.

123. The ripened ovary with its contents, is the **Fruit.** When it adheres to the ovary, the calyx also becomes a part of the fruit. In the apple and pear the calyx forms the entire part of the fruit that we eat; the **Core** is the ripened ovary containing the seeds.



PEAR.

124. Some fruits, commonly so called, are not fruits at all, according to the definition just given. A strawberry, for example, is only an enlarged and pulpy stem (receptacle), bearing on its surface the real fruits, the ripened ovaries, commonly called seeds.

STRAWBERRY.

125. When, as the ovary ripens, its wall thickens and becomes soft, we have what is called a **Fleshy Fruit.** The Gooseberry, Blueberry, Cranberry and Currant, the Tomato and the Grape, are examples of fleshy fruits. The Pumpkin, Squash, Cucumber and Melon are examples of another sort of fleshy fruits. The Apple, Pear and Quince are also examples of fleshy fruits; but here the fleshy part is made up of the thickened walls of the calyx tube, and not of the softened wall of the ovary.

126. When a fruit is partly hard and partly soft or fleshy, it is called a **Stone-Fruit.** The Cherry, the Plum and Peach are familiar examples.

127. We have seen that the pistil is formed from a leaf. Now, the stone of a stone-fruit is formed from the upper part

of this leaf (the inner part when rolled), while the lower part of the leaf forms the outer, soft or fleshy portion.

128. It is a curious fact that leaves are much denser on the upper than on the under side.

129. When the walls of the ovary remain herbaceous in texture, or become thin, we have the **Dry Fruit** The real or botanical fruit of the Strawberry, and the fruit of the Buttercup, are examples of dry fruits.

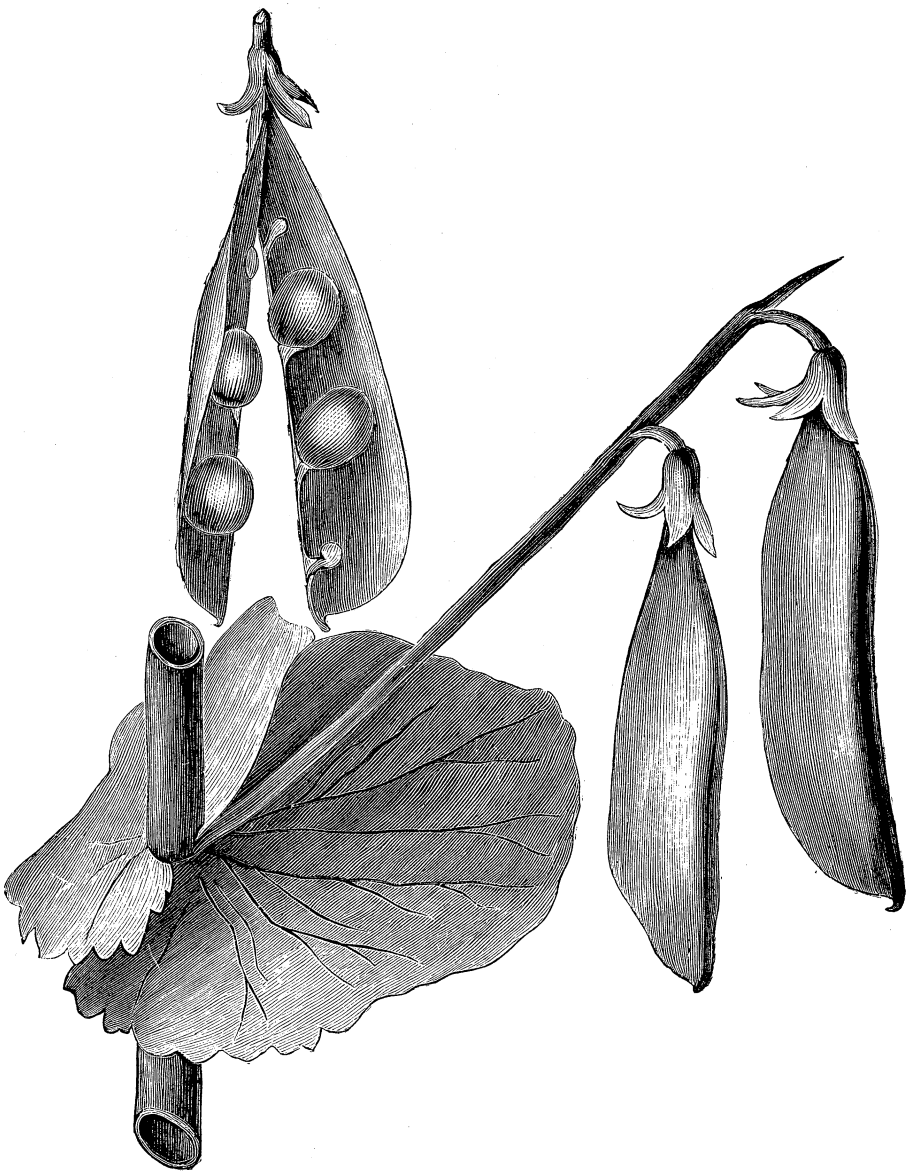
RASPBERRY.

130. In the Raspberry and Blackberry, each grain or globular portion is a pistil that has ripened into a miniature stone-fruit, so that in the Strawberry we eat the stem or

receptacle; in the Raspberry we eat a cluster of stone-fruits, like cherries on a very small scale; and in the Blackberry we eat both a cluster of stone-fruits and the stem or receptacle on which they grow.

BLACKBERRY,

131. When the wall of the ovary is thin and adheres to the seed, so that the wall and the seed seem to be incorporated into one body, the fruit is called a **Caryopsis** or **Grain.** Wheat and Indian Corn are familiar examples.



LEGUME.

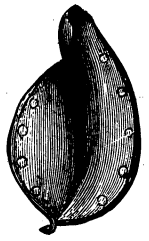
132. When the seed is enclosed in a hard or bony wall, the fruit is called a **Nut.** The Acorn is, botanically speaking, a *nut.*

ACORN.

133. The fruit of the Maple, the Elm, the Ash, is called **Samara** or **Key-Fruit.**

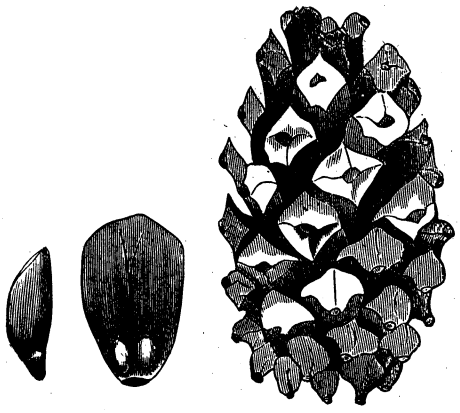
134. A simple pod with its contents, such as constitutes the fruit of the Pea or Bean, is called a **Legume.** In the pod we readily see the structure of the pistil. The edges of the rolled leaf unite, and form the part to which the seeds are attached, and the seam opposite is the midrib of the leaf.

135. When a pod opens only along the inner suture, it is called a **Follicle.**



FOLLICLE.

136. The peculiar pod of the Mustard family is called a **Silique.**



CONE.

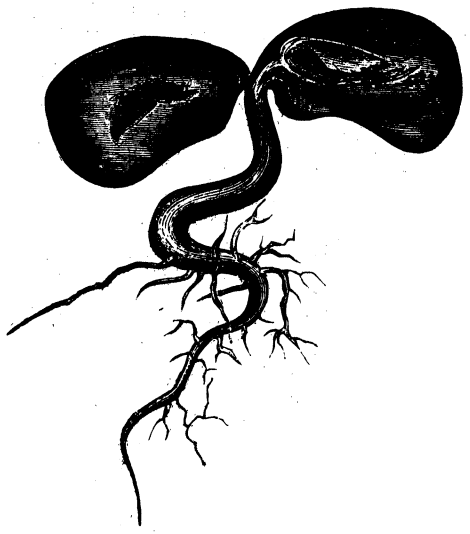
137. The fruit of the Pines, Spruces and the like, is called a **Strobile** or **Cone.** These cones consist of a collection of open pistils on a long receptacle, each bearing one or two naked seeds on its edges, near the base.

LESSON XIII.

THE SEED.

138. The seed consists of two things, a miniature plant called the **Embryo,** and a quantity of starch which surrounds this embryo and furnishes it food.

139. Soak a bean in warm water a few hours, or put it in warm, moist earth for a day or two, and then examine it. You will plainly see the little plant nicely packed in its store-house of food.



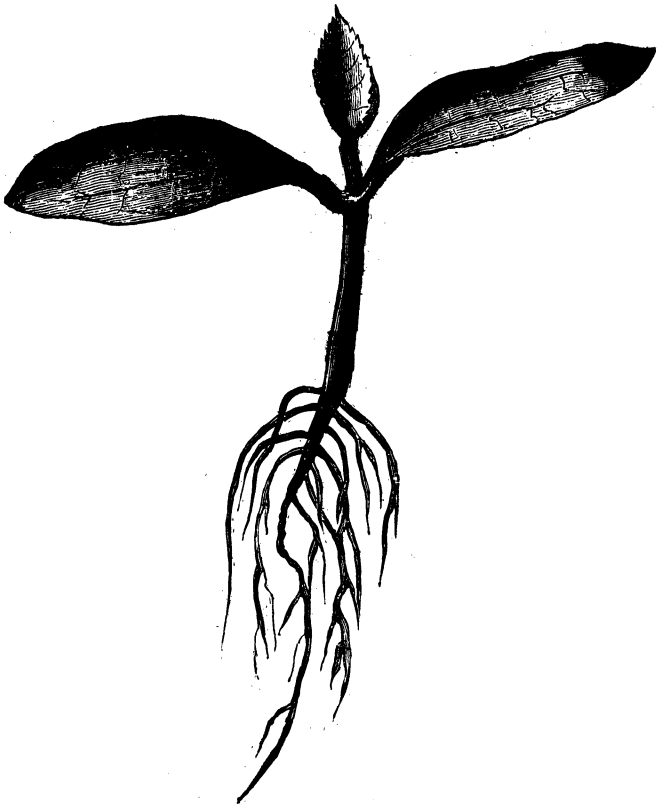
GERMINATING BEAN.

140. This starch is slowly converted into sugar, and, when it is thus changed, is dissolved, and the little plant feeds upon and consumes it. Then the plant is able to obtain its food from the earth and air.

LESSON XIV.

HOW PLANTS GROW.

141. A plant grows from the seed, becomes an herb, a shrub or a tree, matures seeds, and these seeds in turn produce other plants.



GERMINATING PLANT.

142. The increase of a living thing in size and substance is called **Growth.**

143. If we examine a leaf, or any part of a plant, with a microscope of high power, we find that it is made up of **Cells.** These cells are from one-thirtieth to one-thousandth of an inch in diameter, commonly from $\frac{1}{300}$ to $\frac{1}{1000}$ of an inch. Thus there are commonly, from twenty-seven million to one hundred and twenty-five million cells in a cubic inch.

144. The botanist observes three steps in all vegetable growth:

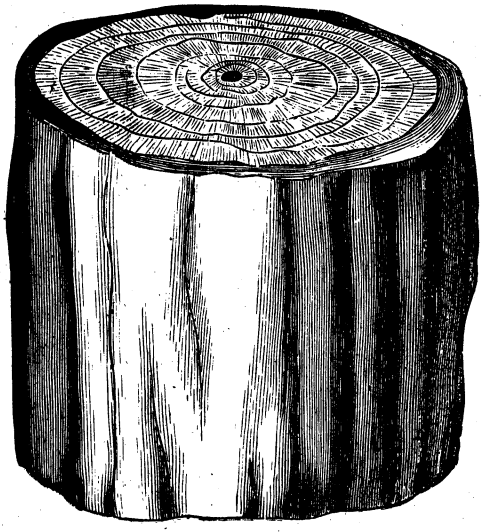
First, the growth of each cell until it attains its full size;

Second, the multiplication of the cells in number; and,

Third, the arrangement of these cells in some regular order, thus producing definite forms.

145. This collection of cells constitutes what the botanist calls **Cellular Tissue**; and when the walls of the cells become thick and hard, they form the **Wood.** This woody material is arranged in two different ways, making two kinds of woody stems.

146. One kind we see in the Corn-stalk; the other in the Oak and Maple—in fact, in all our common trees. The former is called the **Endogen** or "**Inside Grower;**" the latter the **Exogen** or "**Outside Grower.**"



EXOGENOUS STEM.

ENDOGENOUS STEM.

147. In the Endogen we find the oldest and hardest fibers of the wood next to the surface, and the newest, softest fibers at or near the center.

148. In the Exogen we find a layer of new, soft wood on the outside or surface of the stem, and the hardest, oldest wood inside, toward the center.

149. A layer or circle of wood is added each year; so that by counting these circles we can determine the age of the tree.

150. Each of these kinds of stems has these characteristics: 1st, the Endogen grows from the inside; 2d, it bears

parallel-veined leaves; 3d, its seeds produce but one seed leaf.

151. 1st, the Exogen grows by additions to the outside; 2d, it bears net-veined leaves; 3d, its seeds produce two seed leaves.

152. In the exogen the *living parts* of the plant are, the rootlets at one extremity, the bud and leaves at the other; and these are connected by two contiguous zones of the newest or latest growth, one of wood and one of bark. These parts of the tree are renewed every year.

LESSON XV.

THE CHEMICAL COMPOSITION OF PLANTS.

153. If we completely burn a leaf or bit of wood, almost all of it disappears into and becomes a part of the air. Nothing but the ash (ashes) remains. This ash is the part of the plant that came from the earth. The part that disappeared in the air, amounting to from eighty-eight to ninety-nine per cent., is the part that came from the air.

154. The plant, then, feeds upon the earth and air. It converts the lifeless, inorganic elements into living or organic things.

155. In the foregoing lessons we have had under consideration only the higher classes of plants. There are others, of lower grades, called **Cryptogamous** or **Flowerless Plants**; such are the Ferns, Mosses, Sea-weeds, Mushrooms, etc. These are more difficult to study, but to the advanced student in Botany are intensely interesting.

SUGGESTIONS,

MODEL LESSONS

AND

EXAMPLES.

SUGGESTIONS.

MODEL LESSONS AND EXAMPLES.

This little work is intended for a *text-book*. The teacher, with the aid of specimens of plants or parts of plants, can elaborate the text — preach the sermon. The book does not treat of *details* of any one of the subjects, but aims to fix in the mind of the pupil the general outline, the *main points* of each topic.

It is better to study *plants* to get a knowledge of *Botany*, than to study *Botany* (the book) to get a knowledge of *plants*. Everything that the book teaches about plants (except the names) may be learned by studying the plants themselves. The book may also assist the pupil, by directing him how and where to find things. It will also lead him to follow some systematic order, so that what he learns shall not be to him a mass of disconnected, unrelated facts, but an harmonious whole.

Let the pupil bring leaves, such as he can find, and study their forms. Let him examine them as to their *general outline*, *base*, *margin*, *apex*, and compare them with the cuts or figures in the book.

He will soon learn that several of the names used in describing leaves, may apply to one and the same leaf; as,

for instance, a leaf may be lanceolate as to its general outline, while the base may be more or less cordate or sagittate, its apex acute or acuminate, its margin dentate or serrate, etc.

Again, he will find leaves that do not correspond exactly to any one of the forms mentioned, and to describe which would require such terms as linear-oblong, oblong-lanceolate, lance-linear, roundish-ovate, broadly linear, oblong-ovate. These and many other such compound names are used by the botanist in describing leaves. The pupil might find it difficult, for instance, to tell whether the leaf of the common Lilac is cordate or ovate; the botanist describes it as cordate-ovate.

Let the pupil bring leaves, stems of various forms, flowers, fruit, in fact anything that will assist him to understand the subject in hand.

In the closing pages of this Appendix I have given examples of the different leaf-forms, and of the several parts of the plant spoken of in the text. They are given as examples simply, only a few of the many. The teacher may find others that are better. I have endeavored to give such as are familiar, and the examples of leaf-forms are typical, that is, each is quite exactly of the form indicated by the name. For instance, there are many leaves that are somewhat lanceolate or cordate or ovate — not exactly lanceolate or cordate or ovate, but approaching these forms. The examples given have such forms as would readily be recognized by *comparing them with the figures in the book.*

The numbers accompanying these examples correspond with, and relate to, the paragraphs in the text.

I herewith append a suggestive lesson or two, that may

serve to assist the teacher in the use of the book. I do not suppose that every teacher will pursue exactly my plan; at the same time, these lessons may be helpful in indicating the manner in which the text may be expounded to the edification and profit of the pupil. The length of a lesson, of course, will depend upon the age and capacity of the pupil, and the time given to a recitation.

Suppose the lesson is about *Buds*. (The time Spring, before the leaves have appeared.)

Ask the pupils to bring a quantity of small twigs or "brush." It makes little difference what they are taken from; any tree or shrub will furnish the specimens. It would be better if the specimens were somewhat branching.

Each pupil in the class having taken one of these branching twigs, or bits of brush, ask one what he sees on the end of each branch or stem. He will in all probability answer, "A bud."

Ask him if he finds buds anywhere else on the stem or branch; and he will be very likely to find them along the sides of the stem.

As he finds buds on the ends of the stems or branches, you may tell him to call these "end buds," or "terminal buds;" but be sure he understands *why* they are called terminal, and if he cannot understand this, let him call them "end buds."

Let him call the buds he finds on the sides of the stem and branches, side or lateral buds, because they grow on the sides of the stem. Then proceed to examine more carefully the *exact place* of the buds. Ask if they are arranged in any regular order. Call his attention to the *places* where the

leaves grew the summer before. These places are seen as scars just at the base of the bud.

Then tell him to call these buds *axillary buds*, because each grows in the *axil* of the leaf, if, as before, he understands what and where the *axil* of the leaf is.

Call attention to the size of the end buds and the side buds, and ask him to compare one kind with the other, and see if one is larger than the other.

If he has a twig of Maple or Hickory, you will ask him to observe that the end bud is larger and stronger than the lateral or side ones; and if the main stem of his specimen has branches, ask him to compare the end bud on a branch with the end bud of the main stem. Ask him to notice that the end bud of the main stem is larger than the end buds of the branches.

Having fixed the *places* of the buds, next ask him to examine a bud carefully, to see what it is made up of. If the bud is somewhat developed — that is, has begun to expand,— he can readily see the small scale-like leaves, and that these small scale-like leaves are attached to a short stem. Perhaps he may be able to count the number of leaves in the bud. Ask him how the bud would appear if the leaves were arranged much farther apart, or the stem made longer while the *number* of leaves remained the same. In this way you may show how the bud develops into a *branch*.

You may further illustrate the matter by arranging a number of disks or bits of paper on a rubber cord; then, taking hold of the ends of the cord and stretching it, the bits of paper will be drawn further apart, just as the leaves

in the bud are separated widely from each other by the elongation of the stem.

The stem may grow five or six feet in a single season; but it will bear no more leaves than were contained, or were packed, in the *bud.*

Call attention to the flower bud — to the different manner of its development. The axis or stem of the flower bud remains short. The leaves expand or grow large, differing from the leaves of the foliage bud in *form* and *color.*

Again, call attention to the fact that the character of the buds determines the character or form of the tree as a whole. If the end or terminal bud is much larger and stronger than the side, lateral or axillary buds, the tree will have a straight central shaft, extending from the ground to the very top. The terminal bud develops and continues the main stem, and the axillary buds produce the branches. The Hickory, Pine, Spruce, are good examples.

On the other hand, if there is little or no difference in the size of the buds, the tree will not have a main central axis, but the branches will divide and subdivide, until the whole top of the tree is a vast collection of small twigs. The Elm is a good and familiar example.

Now the buds of a single branching limb will tell you at a glance whether it is from a tree of the Hickory kind or from a tree of the Elm kind.

Suppose the lesson is about *Fruit.* Call attention to the definition of fruit, as given in paragraph 123.

Keep the fact in mind that the pistil, of which the *ovary* is a part, is a form of leaf, and that if a flower has a number of simple pistils, it will produce or ripen a cluster of simple fruits, each pistil producing a single fruit.

The Blackberry blossom has many simple pistils, the ovaries of which become simple fruits; and as the pistils are borne on the stem, or receptacle, of the flower, so will each of the fruits be borne on the stem, or receptacle.

Let the pupil see and understand that the Blackberry is really a *collection* of blackberries on an enlarged and pulpy or juicy stem, and that we pluck and eat this *stem* with the simple berries upon it.

In the Raspberry, the fruits, the ripened ovaries, grow upon a smaller stem or receptacle; but when we pluck the Raspberry, or rather the collection of berries, these berries are detached from the stem, and we eat the berries only.

If the stem or receptacle of the Blackberry were to become thickened and enlarged much more than it is, and the real fruits, the ripened ovaries, were thin and dry, and each adhering closely to the small seed, we should have the form and structure of the Strawberry.

On the other hand, if the receptacle of the Strawberry were smaller, and the *real fruits* (commonly called seeds) were enlarged, the walls of the ovaries (which enclose the seeds) becoming thick and juicy, we should have the form and structure of the Blackberry.

Call attention to the apple blossoms. Observe that the petals fall off, and the stamens wither away, while the calyx grows thick and juicy, and becomes that part of the apple that we eat. The pistil becomes the core, or real fruit, containing the seeds.

The same general plan may be pursued with any of the subjects treated of.

8. *Examples of Stipules.*
Apple, Clover, Locust, Pea.

9. *Examples of Sessile Leaves.*
Locust, Purslane, Lead-Plant, Bur Marigold.

12. *Examples of Parallel-veined Leaves.*
Lily of the Valley, Corn, Grasses and Grains.

13. *Examples of Netted-veined Leaves.*
Maple, Pea, Bean, Squash.

14. *Examples of Feather-veined Leaves.*
Elm, Oak, Apple.

15. *Examples of Radiate-veined Leaves.*
Maple, Button-wood, Pumpkin, Cucumber.

17 *Examples of Leaf-forms, as to General Outline.*
LINEAR: Spring Beauty, the Grasses, Oats, Wheat.
LANCEOLATE: False Flax, Peach, Pink, some Violets.
OBLONG: Horse-radish, White Clover, Red Cherry.
ELLIPTICAL: One of the Magnolias, Sweet Buckeye, Bouncing Bet.
OVAL: Touch-me-not, Red Clover, Black Thorn.
OVATE: Raspberry, Blackberry, Pear.
ORBICULAR: Golden Saxifrage, Twin-flower, Arrow-wood.
OBLANCEOLATE: Lupine, Cherry, Laurel.
SPATULATE: Wild Daisy, Valerian, Hound's-tongue.
CUNEATE: Hop-clover, False Indigo, Hawthorn.

18. *Examples of Leaf-forms, as to the Base.*
CORDATE: Common Blue Violet, Pansy, Hollyhock.

RENIFORM: Marsh Marigold, Wild Ginger, Mallow.
AURICULATE: Sheep Sorrel, Magnolia (one species).
SAGITTATE: Arrow-head, some of the Mustards, Knot-weed.
PELTATE: Water-shield, White Lily, Mandrake.
HASTATE: Sorrel, Buckwheat, Joint-weed.

19. *Examples of Leaf-forms, as to the Apex.*
ACUMINATE: Mountain Ash, Fuchsia, Water-parsnip.
ACUTE: Choke-cherry, Wild Rose, Sheep-berry.
OBTUSE: Golden Aster, Pawpaw, Rue.
TRUNCATE: Whitewood, Sweet-scented Clover, Vetch.
RETUSE: Yellow Clover, Tares, Bladder Senna.
OBCORDATE: White Clover, Wood-sorrel, Scorpion, Senna.

20. *Examples of Leaf-forms, as to the Margin.*
ENTIRE: Flax, Quince, Elecampane.
SERRATE: Basswood, Black Cherry, Iron-weed.
DENTATE: Wild Snakeroot, Groundsel.
CRENATE: Twin-flower, Ground-ivy, Catnip.
REPAND: Laurel Oak, and some other species of the Oak.
SINUATE: False Violet, Evening Primrose, Pennywort.
INCISED: Fire Weed, some of the Maples.

21.
- LOBED: Liver-leaf, Sugar Maple.
- CLEFT: Washington Thorn, Burdock, Vervain.
- PARTED: Elder, and some of the Anemones.
- DIVIDED: Water-leaf, Strawberry.

23. *Examples of Compound Feather-veined Leaves.*
Prairie Clover, Locust, False Indigo, Walnut.

23. *Examples of Compound Radiate-veined Leaves.*
Horse-chestnut, Sweet Buckeye, Five-finger.

24. *Examples of Perfoliate Leaves.*
Bellwort, Honeysuckles, Boneset.

44. *Examples of the Root-stock.*
Blue Flag, Solomon's Seal, Wake-robin, Bellwort.

45. *Examples of the Tuber.*
Common Potato, Artichoke, Sweet Potato.

46. *Examples of the Corm.*
Crocus, Putty-root, Gladiolus.

47. *Examples of the Bulb.*
Lily, Onion, Hyacinth, Tulip.

50. *Examples of the Stolon.*
Hobble-bush, Black Raspberry, Gooseberry.

51. *Examples of the Runner.*
Strawberry, Five-finger, Bugle-weed.

52. *Examples of the Tendril.*
Grape vine, Cucumber, Squash, Virginia Creeper.

57. *Examples of Epiphytes* (not common).
The Long or Black Moss of the Southern States, Lichens, and some Mosses. The latter are not *flowering* plants, however.

58. *Examples of Parasites.*
Mistletoe, Dodder, Beech-drops, Pine-sap.

65. *Examples of the Raceme.*
Common Locust, Currant, Choke Cherry.

66. *Examples of the Corymb.*
Hawthorn, Cockspur, Haw, Pear.

67. *Examples of the Umbel.*
Milkweed, Primrose, Caraway, Parsnip.

68. *Examples of the Spike.*
Mullein, Plantain, Vervain, Grasses (compound).

69. *Examples of the Head.*
Button-ball, Button-bush, Dandelion, Thistle.

71. *Examples of the Panicle.*
Catalpa, Oat, and the common Grasses.

73. *Examples of the Cyme.*
Bladder-nut, Chickweed, Spearmint, Horsemint.

74. *Examples of the Fascicle.*
Sweet-William, Lychnis.

75. *Examples of the Glomerule.*
Hoarhound, Motherwort.

87, 89. *Examples of Perfect Flowers.*
Flax, Geranium, Rose, Pink. These are also *regular* flowers.

90, 92, 93. *Examples of Imperfect Flowers.*
DIŒCIOUS: Willow, Poplar, Moonseed.
MONŒCIOUS: The Oak, Walnut, Nettle.

94. *Examples of Incomplete Flowers.*
Castor-oil Plant, Windflower.
NAKED: Willow, Lizard's-tail.

95. *Examples of Irregular Flowers.*
Dutchman's Breeches, Lark-spur, Violet.

115. *Examples of Simple Pistils.*
Peony, Lark-spur, Marsh Marigold, Pea, Bean.

115. *Examples of Compound Pistils.*
Blue Flag, Spiderwort, Apple.

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